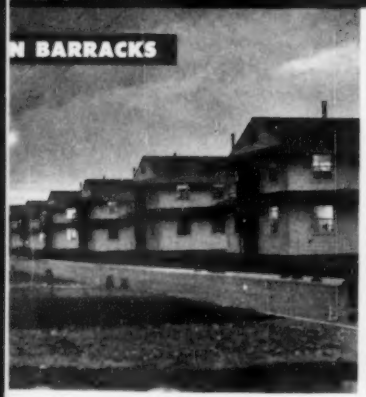
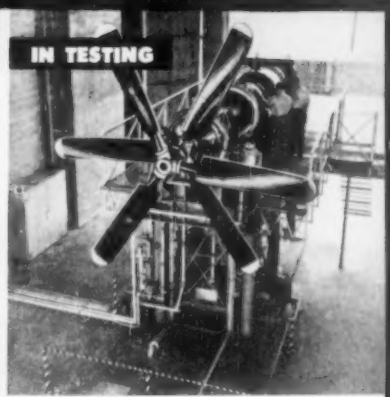
AVIATION WEEK

50 CENTS





1000 = 1

on the ground **in the air**

No one seems to have worked out specific figures on the *total number* of people on the ground it takes to keep one man in the air.

But a ratio of a thousand-to-one would be a pretty fair estimate – if you included administrative and production workers as well as operating personnel.

And this same ratio would make a pretty fair estimate, too, when it comes to Honeywell controls.

That is, for every Honeywell autopilot, fuel measurement system, gyro, actuator or other control in the air, a thousand other strictly "chairborne" Honeywell controls are called for on the ground. Controls that furnish comfortable, workable "climate" in offices, barracks, hangars, cafeterias and clubs. Controls that promote efficiency on the aeronautical production line. Controls that promote efficiency on the processes and conditions in labs and in field tests. Precise instruments that control industrial

New development programs for both ground and airborne controls for the aviation industry are constantly being initiated at Honeywell. And their number will increase in the years to come – because *automatic control* is such an important part of aviation progress. And *automatic control* is Honeywell's business.

MINNEAPOLIS

Honeywell

Aeronautical Controls

H

engineered to an

ENTIRELY NEW CONCEPT

of efficiency

By engineering to new basic principles, this Hydro-Aire Gate Valve offers many innovations and advantages. It is lighter, smaller, and less expensive. Rubber has been completely eliminated. The introduction of an entirely new type clutch and manual override offers far more efficient and safer operation.

Here is an engineering accomplishment, thoroughly tested, completely proved and in production, ready to deliver to you a new concept of Gate Valve efficiency and simplicity.

Sizes ¾", 1", 1½", 2". Manual override. Position indicator. Operates with all aircraft fuel, engine oil, hydraulic oil, alcohol, water, air, and gas. Manually operated version available.

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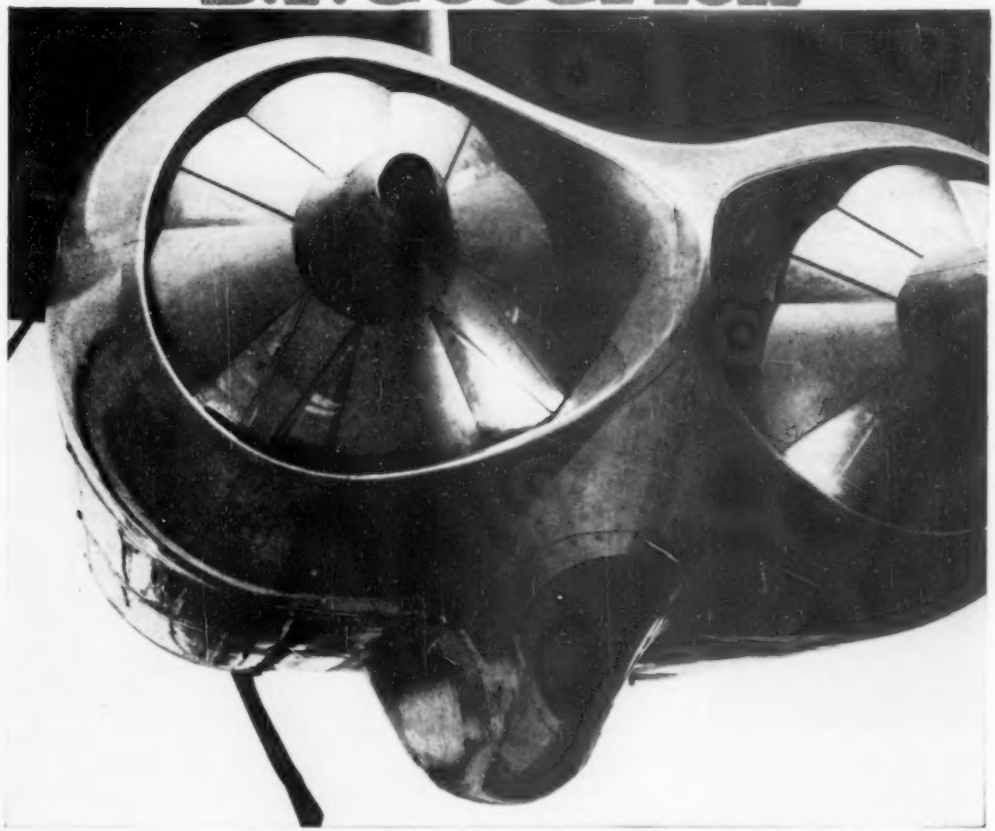
every bomber, every fighter, every transport is Hydro-Aire equipped

B.F.Goodrich



Wafer-thin rubber sandwich solves icing problem

THIS JET ENGINE has only a part-time job. It provides extra power when the Convair B-36 takes off, in gaining desired altitude, and for that extra burst of speed needed over target areas. The rest of the time, it has to be covered to keep the air from going inside.

That's the reason for the shutter-like "doors" you see. Doors that *must* open when the extra power is needed. And ice forming in flight could seal the doors tight. Heat had to be provided, yet the shutters had to be almost wafer-thin. The manufacturer of the doors thought he could do it by making the shutters like a sandwich—if the sandwich filler could be made thin enough and still provide the amount of heat needed to keep off ice.

The experience of B. F. Goodrich with hundreds of airplane icing problems came in handy on this one. It took some precise engineering to solve the tough problem of thinness, but it was done. The heater that turned the trick is only $\frac{1}{20}$ of an inch thick! The core of resistance wires is imbedded by a unique BFG method into a layer of Fiberglas impregnated with rubber-like material. It provides all the anti-icing heat needed to keep the doors ice-free at all times!

B. F. Goodrich offers the aviation industry a background of almost 25 years' experience in anti-icing problems, working with both heat and pneumatic De-Icers. Other BFG products for aviation include: tires, wheels and brakes; Plastilock adhesives, Pressure Sealing Zippers; fuel cells, Rivnuts, accessories. *The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio.*

B.F.Goodrich

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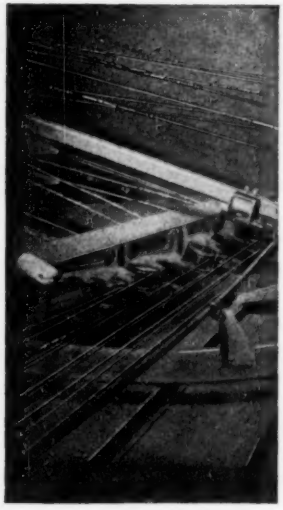
AIRCRAFT CONTROLS

There's almost no "constructional stretch" in Roebling Aircord



BEYOND MEETING today's most stringent specifications, Roebling Preformed Aircord for controls contains practically no troublesome and unpredictable "constructional stretch." For this reason, Roebling Aircord always affords maximum uniformity of control and minimizes the need for periodic take-ups.

Roebling Preformed Aircord, made of steel or of stainless steel, comes in a full range of sizes and can be furnished in complete assemblies with swaged terminals that possess the full strength of the cord itself.

Write for complete information about Aircord and other test- and time-proven Roebling aircraft products. And call on Roebling's engineering staff for any desired suggestions and assistance. John A. Roebling's Sons Company, Trenton 2, New Jersey.

Branches and warehouses in principal cities.

ROEBLING

Aviation Week

ABP Member

Volume 57 **December 15, 1952** **Number 24**

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ORGANIZATION TO SERVE YOU . . .

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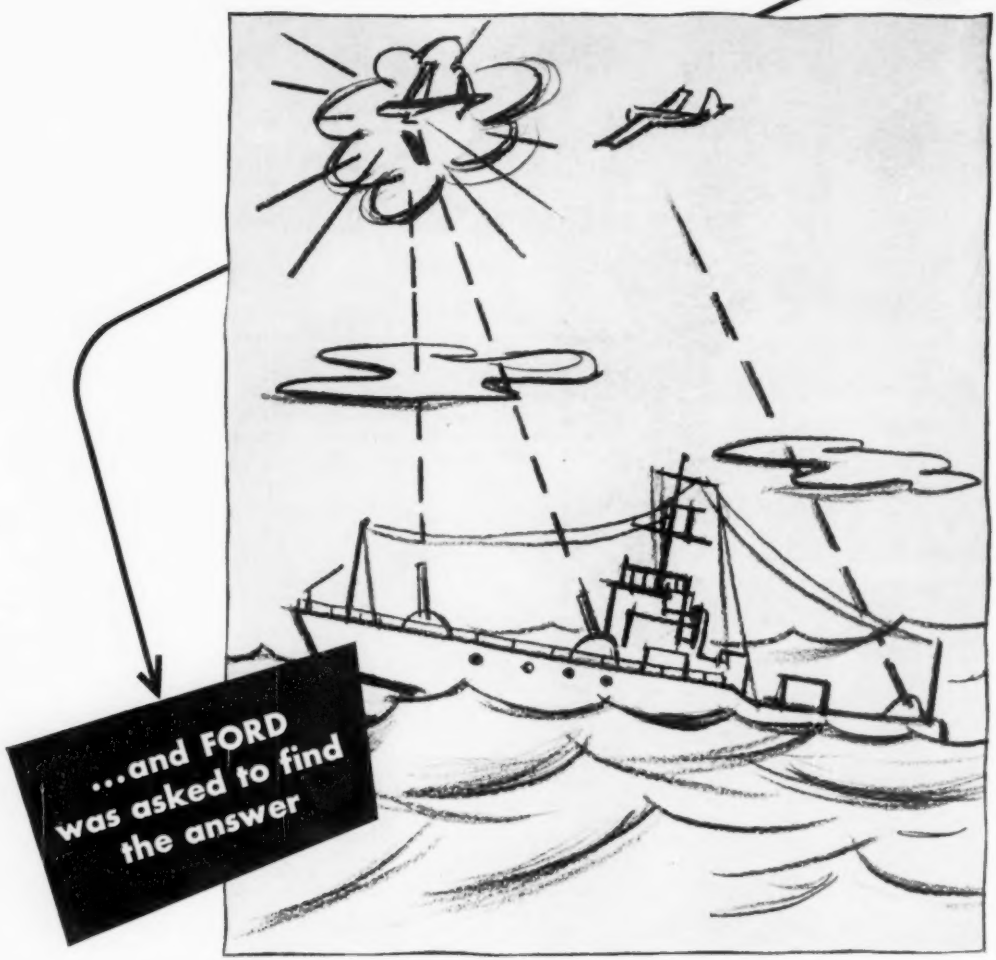
AERO DESIGN *Commander*

TULAKES AIRPORT • OKLAHOMA CITY, OKLAHOMA

TO HIT TARGET
from unstable decks of ship



A rolling, pitching ship . . . under attack from speedy, diving aircraft . . . counts on its anti-aircraft guns for protection . . . these guns must be able to stay on the target regardless of sea conditions. That's why the Ford Instrument Company was called on to design and build a control system that tracks and holds the target range with deadly accuracy.

This is typical of the problems that Ford has solved since 1915. For from the vast engineering and production facilities of the Ford Instrument Company, come the mechanical, hydraulic, electro-mechanical, magnetic and electronic instruments that bring us our "tomorrows" today. Control problems of both Industry and the Military are Ford specialties.

You can see why a job with Ford Instrument offers young engineers a challenge. If you can qualify, there may be a spot for you in automatic control development at Ford. Write for illustrated brochure.

FORD

FORD INSTRUMENT COMPANY
DIVISION OF THE SPERRY CORPORATION
31-10 Thomson Avenue, Long Island City 1, N. Y.

NEWS DIGEST

Domestic

Boeing's XB-52 Stratofortress recently underwent engine calibration tests at Edwards AFB flight test center after completion of its first cross-country flight. The eight-jet bomber now has returned to Larson AFB, Moses Lake, Wash.

Civil Aeronautics Administration reports that during the last fiscal year airport traffic control towers under CAB operation handled 16,673,562 landings and takeoffs, an increase of 2% over preceding year. Civil aviation other than airlines accounted for most of activity, with a total of 9,122,481 operations. Airline traffic increased 10% to 4,711,034. Operations and military traffic increased 11% to 2,840,047. Operations were highly concentrated: 63 airports had more than 100,000 operations each; 26 had totals of more than 150,000, and 11 had more than 200,000. Cleveland tower was busiest with 327,943 operations.

Eastern Air Lines reports it lost an estimated $1 million revenue during one-week walkout, which began Dec. 1 of 165 flight engineers (AFL) on Model 749 and 1049 Constellations. Normal operations were restored Dec. 6.

Justin A. Fitz, director of advertising and information for the Sperry Gyroscope Co., died Dec. 9, apparently of a heart attack. He recently concluded his thirty-fifth year of service with Sperry, where, in addition to writing instruction books, publicity and advertising, he was editor of the house publication, Sperryscope.

Preliminary indications are that the fatal crash near Staten Island, N. Y., airport on Dec. 9 of the British-built executive-type twin-engine de Havilland Dove which resulted in death of the pilot, Robert Franks, and co-pilot, Thomas F. Martin, was caused by a stall at low altitude. No malfunctioning of the aircraft was indicated, it was said. The craft belonged to Pacific Airmotive Corp. and was being demonstrated for Martin, chief pilot for Avco Manufacturing Co., Newark. Two passengers both accredited pilots, escaped with injuries.

Strategic Air Command has received the 1951 Daedalian Trophy for flying safety. Trophy is awarded annually to the AF command which achieves the lowest adjusted aircraft accident rate during the year.

AIR PERMIT authorizing Philippine Air Lines to add Mexico City to its international route is signed by PAL president Andres Soriano while Angel Martin Perez, Mexican director of civil aviation watches. CAB approval to amend the carrier's permit to exercise traffic rights between the U. S. and Mexico is pending. PAL's U. S. stop is in San Francisco.

Lycoming-Spencer division, Avco Manufacturing Corp. has announced a 5-year licensing agreement with Piaggio & Cie., Genoa, Italy, for manufacture of two Lycoming engines, the GO-435-C2 and the O-435-A.

The Daniel and Florence Guggenheim Foundation is now accepting applications for 1953 jet propulsion fellowships for graduate study in rocket and jet propulsion engineering. Grants will amount to $18,000 each at the Guggenheim Jet Propulsion Centers at Princeton University and California Institute of Technology.

Lockheed Aircraft Corp. has announced completion of master plan for jet flight center, to cost an estimated $20 million during next year and a half, at Palmdale, Calif. Construction bids will be received until Dec. 22.

Dr. Antonio Ferri, professor of Aerodynamics at Polytechnic Institute of Brooklyn, has left for Italy to direct the Italian supersonic aircraft research phase of the North Atlantic Treaty Organization's aerodynamics program.

Douglas Aircraft Co. has granted pay increases to 30,000 of its employes at Santa Monica and El Segundo, Calif., and Tulsa, Okla. Included is a general 6% increase for salaried employes, and 5-cent-an-hour increases for hourly paid employes.

Lockheed Aircraft Service, Inc., has been awarded contracts worth about $2 million for conversion of 22 Constellation and DC-6 first-class transports into high-density aircoach, scheduled to be completed by June 30, 1953, at Lockheed bases at N. Y. International Airport and Burbank, Calif.

San Diego division of Convair last week delivered to USAF the last of more than 130 B-36 bombers that have been modernized there for the Strategic Air Command. Production of B-36 components will continue at San Diego but any further B-36 modification programs will be shifted to Convair's Ft. Worth plant.

Northeast Airlines' maintenance crews struck Dec. 5, seriously curtailing the carrier's Convair-Liner services. Supervisory personnel took over and NEA was able to get some DC-3 services functioning, but an estimated 800 of the airline's daily 1,200 passengers had to seek other transportation.

Financial

Lockheed Aircraft Corp. reported net earnings for nine months ending Sept. 30 of $4,944,000 after taxes. A fourth dividend for the year of 30 cents a share was paid Dec. 12 to stockholders of record Nov. 21. An additional 10% stock dividend is to be distributed as soon as possible on the basis of shares issued and outstanding on Dec. 23. Backlog of $1,933,963,000 was reported. Two subsidiaries, Lockheed Aircraft Service, Inc., and Lockheed Air Terminal, Inc., showed net earnings for the same period of $343,732 and $181,426 respectively.

Continental Air Lines has declared a dividend of 12½ cents a share on its common stock, payable Dec. 29 to stockholders of record Dec. 15.

G. M. Giannini & Co., Inc., has declared a dividend of $12 a share on the firm's 6% cumulative convertible preferred stock, payable Dec. 31.

Lear, Inc., will pay a dividend of 10 cents a share Dec. 27 to stockholders of record Dec. 20.

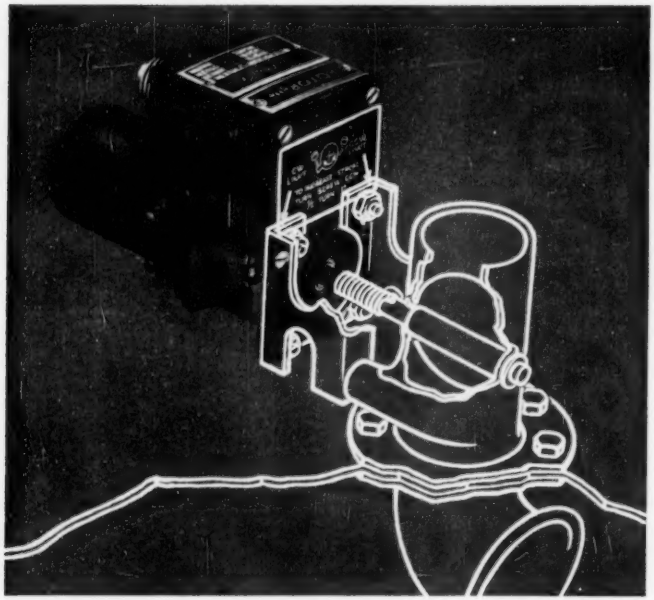
International

International Civil Aviation Organization will hold in Brazil the ninth session of the organization's legal committee which will study and revise the text of a draft convention prepared in Paris in January to replace the Warsaw convention governing liability of air carriers.

RAM AIR VALVE

ON REPUBLIC'S F-84

Airborne actuated



An R-430 type ROTORETTE® Electric Rotary Actuator operates the valve which controls ram air to the cockpit of Republic's F-84.

This Airborne actuator features adjustable positive stops, load sensitive limit switches, radio noise filter, and weight of less than 1.5 pounds.

Perhaps you have a similar application. Our literature in the I.A.S. Aeronautical Engineering Catalog gives complete information on ROTORETTE and other Airborne electromechanical actuators for the aircraft industry.

AIRBORNE

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AVIATION CALENDAR

Dec. 17—Annual Wright Bros. dinner, 7:30 p.m., Statler Hotel, Washington, D. C. Wright Bros. lecture to be presented by IAS 3 p.m., U. S. Chamber of Commerce auditorium.

Jan. 12-16—Annual meeting and engineering display of Society of Automotive Engineers, Sheraton-Cadillac Hotel, Detroit.

Jan. 14-16—AIEE-IRE-NBS Conference on High Frequency Measurements, Statler Hotel, Washington, D. C.

Jan. 15-16—Fifth Illinois Custom Spray Operators Training School, University of Illinois, Urbana, Ill.

Jan. 19-23—Plant Maintenance Conference, Public Auditorium, Cleveland, O.

Jan. 19-23—Winter general meeting of the American Institute of Electrical Engineers, Hotel Statler, New York, N. Y.

Feb. 12-13—National Aviation Education Council annual meeting, Atlantic City, N. J.

Feb. 18—New York Section of the Instrument Society of America, Hotel Statler, New York, N. Y.

Feb. 18-19—Eighth Annual Society of the Plastics Industry, Reinforced Plastics division, conference, Shoreham Hotel, Washington, D. C.

Mar. 10-11—Eleventh Annual Conference, Society of the Plastics Industry Canada, Inc., General Brock Hotel, Niagara Falls, Canada.

Mar. 25-27—National Production Forum of the SAE, Hotel Statler, Cleveland, O.

Mar. 31-Apr. 2—First International Magnesium Exposition, National Guard Armory, Washington, D. C.

Apr. 4-12—Second Annual International Motor Sports Shows, Grand Central Palace, New York, N. Y.

Apr. 20-23—Aeronautic Production Forum, National Aeronautic Meeting and Aircraft Engineering Display (SAE), Hotel Governor Clinton and Hotel Statler, New York, N. Y.

May 11-13—IRE National Conference on Airborne Electronics, Dayton Biltmore Hotel, Dayton, O.

May 18-22—Fifth National Materials Handling Exposition, Convention Hall, Philadelphia.

June 9-11—Second International Aviation Trade Show, Hotel Statler, New York, N. Y.

Sept. 7-13—1953 SBAC Coronation Year Flying Display, Farnborough, Hampshire.

Sept. 14-17—Fourth Anglo-American Aeronautical Conference, London.

Oct. 10—International Air Race, England to Christchurch, N. Z., entry deadline Jan. 31.

PICTURE CREDITS

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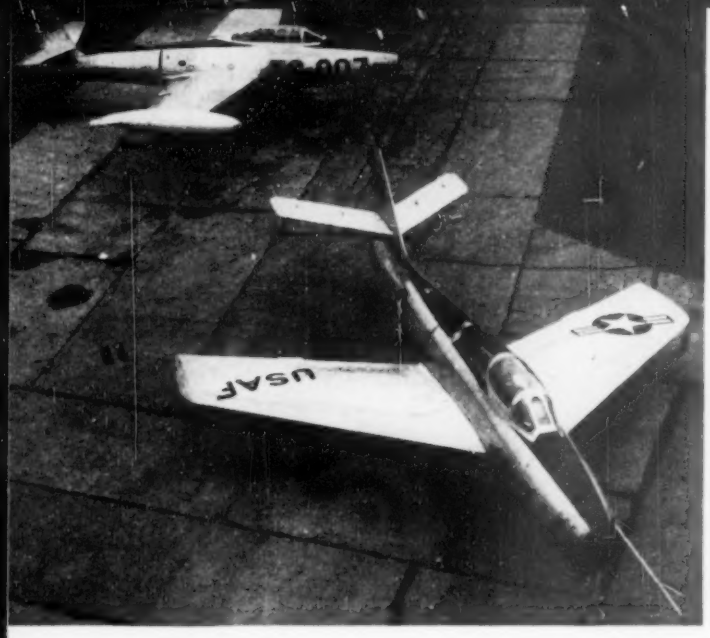
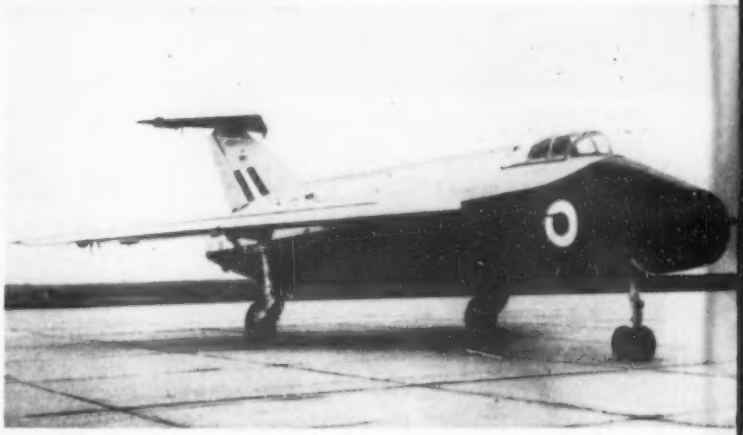


Military Planes In the News

MEET THE THUNDERSTREAK—At left is photo of first production model Republic F-84F Thunderstreak, foreground, with an F-84G Thunderjet behind it affording comparison of the two planes. Differences in wings, tail and cockpit canopies are readily apparent. A large number of F-84Fs are on order for USAF and NATO. A detailed production story on the new Thunderstreak begins on p. 31.

VARIABLE-SWEEP SHORT – New Short S.B.5 (right) is a new British research plane designed to test varying degrees of wing sweep at different speeds. On its first flight the wing was swept 50 deg. main chord. Wings are adjustable only when plane is on the ground, unlike the Bell X-5 and other U. S. planes whose sweep can be varied in flight. The tailplane, perched atop the horizontal tail, reportedly is adjustable. The S.B.5 is powered by a single Rolls-Royce Derwent centrifugal-flow turbojet and has a tricycle landing gear with nose strut having dual wheels.



FRENCH CORSAIR—Vought F4U-7 Corsair (left) in French navy warpaint is one of a number sent abroad under MDAP. This model, fitted with four 20-mm. cannon in the wings and rocket racks, is designed to fight at high altitudes. Powerplant is a P&WA R2800 Double Wasp, giving the plane a top speed of approximately 450 mph. The rugged Corsair, thousands of which have been produced, dates its ancestry back to before World War II. Large numbers of earlier models are used by the Navy in Korea as fighter-bombers supporting ground troops. A specially designed ground-attack model, the AU-1 is in production.

HERE'S DRAMATIC PROOF of the damage an arcing fault can cause in an aircraft. To get this picture, G-E engineers arranged a mockup of an aircraft electrical system, then touched the generator power cable against a test airframe. Note the white-hot glare at point-of-contact!

G-E "PROTECTION RESEARCH" REDUCES ARC-FAULT HAZARDS IN AIRCRAFT

G-E AVIATION SPECIALIST and customer discuss protective measures for commercial air transport. G-E protective systems are now installed on DC-6Bs, Stratocruisers, the Navy's new F3H, and Lockheed Constellations.

Each week, G-E engineers at Schenectady, N. Y., are furthering their "protection research" on aircraft generator systems. And a single glance at the above photograph will tell you why.

One serious arc-fault like that shown above, in just one of your aircraft, could cost more than protective devices for an entire fleet! That's why today G-E protective panels and associated components are being designed to give generator systems *maximum* protection.

Your planes can now be safeguarded against excessive overvoltage . . . ground faults . . . undervoltage . . . reverse current. And these protective features, in turn, mean greater flight safety for passengers and crew.

Why not look into G-E protective-engineering facilities for your new aircraft generator systems? In addition to the a-c and d-c panels and components now being produced, complete design and production facilities are available. Contact your nearest G-E Aviation Specialist. Or, write Section 210-48, General Electric Company, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

WHO'S WHERE

In the Front Office

Clinton Davidson, Jr., has been named president of Resort Airlines and will also continue as chairman of the carrier's board. **Harold L. Graham** has been designated executive vice president and a director. Graham formerly was with Pan American World Airways 14 years.

Edgar Schmued has been appointed vice president-engineering for Northrop Aircraft, Inc., Hawthorne, Calif., where he will be responsible for F-89 Scorpion and guided missiles programs. He previously was technical assistant to **John K. Northrop**, who resigned recently because of ill health.

L. B. Littrell has been named vice president in charge of Pacific Airmotive Corp.'s Chino and Burbank Engine divisions. **H. Y. Finley** has been named a PAC vice president. He had been Burbank Aircraft division manager since 1951. Another new PAC vice president is **Arthur Williams**, manager of the Linden, N. J., division since 1951, who has been placed in charge of the Eastern region.

V. A. Kropff, formerly assistant to the president of Mid-Continent Airlines prior to its merger with Braniff, has been named assistant to the executive vice president, Braniff International Airways, with headquarters in Dallas, Tex.

C. T. Leeds, Jr., formerly chief of the Research and Development division, Los Angeles, U. S. Army, has joined Coleman Engineering Co., Los Angeles, as assistant to the president.

Changes

Parker W. MacCarthy has been named manager of the jet engine section, Electric Appliance Engineering department, at Westinghouse Electric Appliance division, Columbus, Ohio.

R. A. Hamilton has joined Farrand Optical Co., Inc., N. Y., as consulting engineer in the Optical Tooling division.

C. W. Heppenstall has been appointed manager of forging operations at USAF's heavy press plant for aluminum forgings at Newark, Ohio, to be operated by Kaiser Aluminum & Chemical Corp.

John Calvin has been designated hydraulic sales engineer for Pacific division, Bendix Aviation Corp., North Hollywood, Calif. and **Charles E. Ruckstuhl** has been named electronics sales engineer.

A. L. Hall has been appointed chief project coordinator of master scheduling on the Lockheed C-130A turboprop cargo plane being produced at Marietta, Ga., division.

Edmund B. Parke has joined Air Associates, Teterboro, N. J., as factory manager of the Aircraft Products division.

Leonard A. Paris has joined Trans World Airlines' system public relations staff as production manager.

L. James Radin has been named subcontract manager at Engineering & Research Corp., Riverdale, Md., **Richard B. Towsley** has been designated project engineer.

INDUSTRY OBSERVER

► General Electric is gaining industry acceptance of its new X24A turbojet project. The engine's relatively moderate power and excellent weight-power ratio fits into current military planning aimed at using multi-jets in place of extremely high-powered single engines. The multi-jet philosophy was pioneered by the Navy and currently has become popular in USAF.

► **Boeing's new jet tanker, the KB-47 Stratojet, will be a modified B-47B jet bomber equipped with a conversion kit for quick transformation to aerial refueling operations. Two type kits are planned: one using the Flying Boom refueling method for bombers and the other using the probe and drogue method for fighters.**

► Plans for the four-jet B-47C have been shifted to use P&WA J57 turbojets instead of the Allison J71 originally scheduled.

► **Watch for Cessna Aircraft's highly successful experiments with boundary layer control in a Cessna 170 to be incorporated in a new helicopter rotor system. Application of boundary layer control is expected to be a major step in solving the problem of stall on rotor blades during their retreating cycle. Piasecki Helicopter Corp. also is working on application of boundary layer control to helicopter rotors.**

► Beech Aircraft is pushing hard to renew commercial production on its Twin-Bonanza Model 50 and may announce the availability of this plane for commercial sales next month. Military orders have kept the Twin-Bonanza off the commercial market since the sale of the first few pre-production models.

► **Cessna Aircraft's engineers are pleased with the performance of the Boeing 502-8 turbine in the XL-19B lightplane. About 20 hours of turboprop flight time had been logged before heavy fog recently suspended for a week flight operations in Wichita, Kan. Next Cessna gas turbine trial will involve a Continental-built French Turbomeca Artouste powering another L-19 airframe (L-19C). The Artouste is expected to provide about 70 additional horsepower over the 210 hp. of the Boeing turbine. Cessna has an Artouste turbine but is awaiting completion of a propellor gear box being built for it by Continental.**

► USAF flatly denies current industry rumors that Fairchild Engine & Airplane Co. of Hagerstown, Md., will be designated a second source to build the Chase C-123 under license. Undersecretary Roswell Gilpatric said USAF had no plans for such an arrangement under consideration. Chase is controlled by the Kaiser-Frazer Corp., now building the Fairchild C-119 under license at Willow Run, Mich.

► **Recent postwar developments in external fuel tanks for military aircraft either at wingtips or slung under wings are expected to have future applications in the executive aircraft field. External fuel tanks pay a doubled dividend: first, in safety by mounting all fuel away from the cockpit; second, in improved design efficiency. New wing tanks are so clean aerodynamically that their drag can be offset by using thinner wing designs that no longer must accommodate fuel cells.**

► Doman Helicopters, Inc., has set a price tag of $120,000 on its eight-passenger model. It expects to be producing the copter at a rate of one a week by the end of 1953. Price is based on an initial production run of at least 100 helicopters. Doman is going after the export market and hopes to split sales between U.S. services and foreign purchasers.

► **USAF and Navy have rejected industry proposals for reduced final test cell time for aircraft engines that have been given a green run and then disassembled for inspection. The services feel they would rather push for wider use of their statistical sampling method of engine inspection (Aviation Week Aug. 4, p. 213, Dec. 1, p. 17) that eliminates green runs for 9 out of 10 engines when proper quality control has been established.**

Washington Roundup

Naval Air Outlook

Naval Aviation's budget will dip in 1954 fiscal year, which starts next July 1, to around $3.5 billion and then level off by 1955 to around $4.5 billion a year to support planned Naval Air strength, including 16 carrier air groups as well as Marine aviation, unless there is a revision in defense goals by the new administration. This is the picture:

• **The Naval Aviation program,** budget-wise, passed the hump in the 1952 fiscal year, which ended July 1, with a $4.8-billion allocation. This was more than four times the pre-Korea budget of $1.1 billion for the 1950 fiscal year. In fiscal 1951 it jumped to $4 billion.

• **For the current 1953 fiscal,** Naval Air's budget dropped $300 million to $4.5 billion.

• **For the coming 1954 fiscal year,** which starts next July, the drop will be sharper, probably down to around $3.5 billion.

• **The Naval Aviation mobilization goal** of 16 carrier air groups already has been achieved. Actually, the program has been more "modernization" than "buildup." Navy had a 16-group force back in 1949 before the move to slash Naval Air went into swing at the time of the B-36 investigation and the economy regime of former Defense Secretary Louis Johnson. The Korean outbreak, development of atomic weapons for carrier use, and new leadership were factors that averted a planned slash to nine air groups.

Floberg's Report

Navy Assistant Secretary John Floberg, who took over the reins of Naval Aviation in November 1949 when its popularity, notably with the Pentagon's top command and some sections of Congress was at a low point and, along with the late Adm. Forrest Sherman, guided a comeback to favor that has satisfied the admirals, gives this report to AVIATION WEEK on aspects of the program:

John Floberg

▶ **Aircraft Procurement Down**—Funds for aircraft contract letting in the 1954 fiscal year will take another drop, sharper than the drop in funds this year, and then increase the following year.

• **The reason:** A deliberate decision to curtail procurement of "interim type" planes—which could be mass-procured in the event of an emergency.

• **This will result in a deficiency** in numbers of modern operational aircraft in the fleet for some years.

• **But the Navy is pushing production** of advanced types, such as F3Hs, F4Ds, and the numerical deficiency gradually will be alleviated as these higher-performance types are brought into the fleet.

(Funds for aircraft procurement mounted from $540 million in fiscal 1950 to a peak $3.8 billion in fiscal 1952. The allocation fell off to $3.2 billion for the current fiscal year, will probably be less than $2.5 billion for fiscal 1954. But expenditures for planes will be at the peak level in that year, when spending will reflect 1952 fiscal year contracting).

▶ **Guided Missile Procurement: Up**—Naval Air's purchasing of guided missiles will continue upward on a steady and sharp curve.

(Funds for missiles shot from $11 million in fiscal 1950 to $152 million for this year, averaging $67 million a year in the interim period).

▶ **No Challenge to Carrier Aviation?**—Missiles and water-based-aircraft, both being pushed by the Navy, will be supplementary and will not to any substantial extent supplant carrier air.

• **Guided missiles,** for the most part, will be additional weapons to do the job of air-to-air gunnery, anti-aircraft fire and shore bombardment in instances where cheaper and more orthodox weapons would be less effective.

• **Water-based air** will increase the capability of carrier aviation. Seaplanes, for example, might handle a "cleaning up" operation, releasing for an offensive maneuver ships and carrier planes that would otherwise be tied up at the scene.

▶ **Jet Airlift**—Navy will take the lead in development of water-based jet airlift for rapid deployment of Marine detachments to points of action—as soon as advances in aviation indicate that a seaplane transport with operational utility can be developed.

Consolidated's R3Y turboprop water-based transport, now in initial production, is the forerunner. Navy is watching the outcome before moving into the jet field.

▶ **Helicopter Program: Level Off**—Navy's helicopter requirements, mostly for Marine support, have largely been met, but purchasing will continue.

Helicopter procurement, which has varied from $70 to $140 million a year since the Korean outbreak, will drop to around the $70-million level in fiscal 1954.

▶ **No Surplus Planes?**—Navy anticipates no surplus plane disposal problem, as new types are brought into the fleet and obsolete types phased out. The planes retired will be worn out; some parts may be disposed of, but these too, for the most part, will be well worn.

▶ **Adequate Overhaul Facilities**—Naval Air—unlike the Air Force which is being greatly expanded—is pretty much a stable force and at this time requires no additional overhaul facilities. The anticipated work can be handled in Navy's own depots. There is little prospect of additional plane overhaul being farmed out to the industry.

Bucking the Industry

W. A. Patterson's recent move to restrain expansion of aircoach isn't the first time the United Air Lines' president has bucked the majority of the industry—and apparently isn't going to be the last.

• Back in 1947, Patterson urged a "community company" to monopolize all international air routes, as proposed by Sen. Owen Brewster, who was defeated in this year's election. The only other industry support for the plan: Pan American World Airways.

• Now the report is current that Patterson favors abolishing Civil Aeronautics Board and turning airline regulation over to Interstate Commerce Commission or a single regulatory agency—which would have the effect of lumping air and surface transportation regulation under one agency.

—Katherine Johnsen

AVIATION WEEK VOL. 57, NO. 24
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USAF to Buy 20,000 Planes in 3 Years

- **Fiscal 1954 budget to ask for 3,500 aircraft in addition to available funds for 17,000.**
- **Production peak of 800 planes a month expected by next spring; this will taper to 300 a month in '56.**

By Robert Hotz

The Air Force expects to buy more than 20,000 aircraft during the next three years, according to Undersecretary Roswell L. Gilpatric. Funds already are available from fiscal 1951 to 1953 budgets to finance production of some 17,000 planes, with an additional 3,500 planes scheduled for the fiscal 1954 budget now in preparation for submission to Congress in January. The total USAF budget for fiscal 1954 is now $16.4 billion.

The aircraft production curve to meet USAF procurement schedules will continue to rise for another six months, according to Gilpatric, reaching a rate of about 800 planes a month next spring. The production peak is expected in the spring of 1954 when an output of 12 million airframe lb. a month is expected.

Output will hold at this level until the middle of 1954 when it will begin to taper off gradually to a rate of 500 planes a month by mid-1955 and to 300 a month by June 1956.

▶**Plateau in 1956**—The 300-plane-a-month rate is regarded by USAF as the minimum production rate necessary to sustain the 143-wing Air Force once it has been fully equipped with modern aircraft. This production plateau in 1956 is about four times the pre-Korean aircraft production rate in terms of airframe weight to meet USAF requirements. It calls for about three times as many planes per month as the pre-Korean USAF delivery rate.

Gilpatric emphasized that even beyond 1956 a large annual aircraft production program will be required. An annual production rate of slightly more than 2,500 aircraft a year will be required to provide for replacement of normal peacetime attrition of the 143-wing Air Force. This does not include the additional requirements that would be imposed by combat losses should the Korean war continue or other similar types of operation be necessary.

▶**Unspent Billions**—The Air Force still has about $25 billion in unspent aircraft procurement funds from its fiscal 1951 to 1953 budgets, although most of these funds have been obligated. Total USAF procurement budget since fiscal 1951 is $32 billion, representing the cost of 21,000 aircraft plus related equipment and guided missiles.

Although the total USAF budget will be lower in fiscal 1954, expenditures will continue to rise during the remainder of fiscal 1953 and 1954 as production climbs towards the peak delivery rates of 1954.

The reduced USAF budget for fiscal 1954 is possible because most of the capital cost—tooling and new facilities—of the production buildup has been financed out of earlier budgets. Since Korea, USAF has been given about $2 billion to spend for industrial machinery, equipment and facilities.

About one-third of these funds has been spent, according to Gilpatric. USAF has financed only one completely new facility—the Hughes Aircraft missile plant in Arizona. Most of this money is going to finance machine tools, jet engine test cells and facilities for testing control systems and other electronic gear.

USAF now has all of its industrial reserve plants operating, with the exception of the former Glenn L. Martin plant at Omaha, now used as Strategic Air Command Headquarters, and the former Douglas plant at Chicago.

▶**Research Budget Up**—At the same time the production load is decreasing, USAF will face the necessity for increasing research and development and a greatly increased workload of modification, maintenance and overhaul operations for the 143-wing Air Force.

Gilpatric pointed out that research and development appropriations for USAF have been steadily increasing—from $370 million in fiscal 1951 to $451 million in fiscal 1952 and $525 million in fiscal 1953. A further increase in USAF research and development funds is scheduled for the fiscal 1954 budget, according to Gilpatric.

USAF is now developing a program to keep the overall workload high in its major plants after the production load falls off at the end of 1954. Major point of the plan is to use existing production facilities to carry the main burden of the vastly increased modernization, maintenance and overhaul load USAF faces as the 143-wing Air Force comes into being. Bulk of this type work is at present being done at USAF depots.

Under the new plan, depots will continue at their current rate of operations and all of the additional workload imposed by the expanded Air Force will be farmed out to private industry. USAF budget for maintenance has been running about $250 million annually for an 80-90-wing Air Force.

▶**Increasing Load**—This plan will phase in the increasing maintenance, modernization and overhaul load for private

ROSWELL GILPATRIC

10 F-84s a Day

Republic Aviation Corp. is producing F-84G Thunderjet fighters at a rate of 10 a day, according to USAF Undersecretary Roswell L. Gilpatric. Since the plant is on a five-day work week with Saturday as a pickup day, the monthly output of the Farmingdale, L. I., plant is now about 200 F-84Gs. This does not include production of the sweptwing F-84F, first of which recently was delivered to USAF (see p. 31).

plants as their production load begins to decline toward the 1956 plateau. First contracts already have been signed with Allison division of General Motors Corp. and General Electric Co. to overhaul USAF jet engines at Indianapolis and Lockland. USAF is now studying facilities of Packard at Detroit and Studebaker at South Bend for future overhaul of J47 turbojets.

Wherever possible USAF plans to farm out the maintenance and overhaul work to the original manufacturer of the equipment in order to take advantage of his experience with the particular product and also to enable him to retain as much of his skilled labor force as possible. Modernization of aircraft will be a big item in this program because plane types will be retained for active use in a peacetime Air Force much longer than when subject to combat attrition and replacement by new types.

L-5 Autopilot Gets Nod for DC-6A, B

The Lear L-5 automatic pilot and approach coupler have received CAA certification for use on Douglas DC-6A and DC-6B following recent tests on a Slick Airways DC-6A at Los Angeles. The L-5 is a commercial version of the Lear F-5 autopilot used on the North American F-86D and the Republic F-84G.

William Lear, chairman of the board and director of research for Lear, was at the controls of the Slick DC-6A during the CAA certification tests flown under conditions of minimum and maximum aircraft loading. Lear told AVIATION WEEK that the initial L-5 autopilot calibration on the DC-6A was made in a single flight in less than 20 min.

▶ **Big Plans**—Lear is aggressively attempting to enter the airline autopilot market, long dominated by the Sperry A-12 and Eclipse-Pioneer PB-10 autopilots. Lear himself has demonstrated the L-5 to most U. S. and several foreign airlines in recent months and says his company is now developing a plan to lease or sell its L-5s on "very attractive terms." L-5 installations are being planned for all types of U. S. airliners, according to Lear, who says there is a "possibility of an installation being made in the British Comet Jetliner."

Indian Airport Plans

(*McGraw-Hill World News*)

Melbourne—Indonesia has completed plans for nearly doubling the number of good airfields in the country. The three-year project calls for establishing 20 new airports with approximately one-third the appropriation to be spent the first year.

Outlook on GOP Air Appointees

Washington guessing but finds few firm answers; Harold Talbott may be new AF Secretary.

In Washington last week the quadrennial guessing game about who is going to fill the key aviation posts in the new Administration was in full swing, with lots of questions but few firm answers.

New Defense Secretary Charles E. Wilson reportedly has been given a veto power on the secretaries who will serve under him, as a condition of his own appointment. But, subject to Wilson's and other similar vetoes, here was the outlook on new aviation appointments which may be expected in the Eisenhower administration:

• **AF Secretary.** Harold E. Talbott, 64, New York industrialist, who was director of aircraft production for the War Production Board early in World War II, appeared favored to become Secretary of the Air Force.

Others who have been mentioned for this post included John A. McCone, former Air Force Undersecretary; Lt. Gen. James H. Doolittle, vice president of Shell Oil Co.; Maj. Gen. Edward F. Curtis, president of Eastman Kodak; William A. M. Burden, former Assistant Secretary of Commerce for Air; and Brig. Gen. Pierpoint M. Hamilton, Medal of Honor winner in World War II.

• **Navy Secretary.** Unofficial nominations for Secretary of the Navy appeared less positive, but the group mentioned included David Ingalls, Senator Taft's campaign manager and former Assistant Secretary of the Navy for Air; Edward Robertson, Wyoming rancher and former U. S. Senator; Claude Bakewell, former Representative in Congress from Missouri, and Jack Garber, of Gar Wood Industries.

• **CAA.** The Republican replacement for CAA Administrator Charles F. Horne was expected to be selected from a field which included names of two men now at CAA, and probably several others. Mentioned were Joseph Marriott, West Coast CAA regional administrator, and Fred B. Lee, deputy CAA administrator. Reports were that Lee had some strong support among New York Republicans, while Marriott had West Coast Republican support spearheaded by Rep. Carl Hinshaw.

• **CAB.** Harold Jones, former CAB member active in the California campaign this year, is actively campaigning for the CAB chairmanship. He has backing from the biggest airlines and Carl Hinshaw. But regional scheduled airlines and nonskeds oppose him because he was a no-competition man—fought virtually all applications for airline route improvements that would compete with the Big Four domestically and Pan American internationally.

Emory T. Nunneley, CAB general counsel, was interested in taking Jones' place when he resigned from CAB two years ago and is reportedly interested in joining the Board now.

J. Paul Barringer, director of the State Department's Office of Transport and Communications, has also been mentioned as a possibility. One of the few Republicans in State Department policy levels, Barringer may go farther if he remains with State.

▶ **Talbott Reports**—Reports the Air Force Secretary post had been offered to Talbott, turned down and offered a second time, were denied in a newspaper statement attributed to him. He told the Dayton Daily News in a telephone interview that he had heard of the proposal but that the post "had not been offered to me so of course I could not have turned it down."

Talbott has served as the president of the old Dayton Wright Company which manufactured de Havilland 4 two-seat biplanes in World War I. He has lived in New York for many years and has been active in many financial interests. Typical of these were his chairmanship of the board of North American Aviation Corp. in 1931-32, and his more recent affiliation as a director and member of the finance committees of firms such as Chrysler Corp., Madison Square Garden Corp., Mead Corp., Commercial National Bank and Trust Co. He was financial chairman of the Republican campaigns of 1944 and 1948 and assisted in the 1952 financial campaign.

Talbott is a brother of the late Nelson P. Talbott, Dayton, known in aviation circles for his work as a brigadier general at Air Materiel Command and as a director of TWA.

Consensus of informed Washington sources last week was that if Talbott was willing to accept the post, he has an inside track.

Truman Promotes 25 USAF Officers

Eight USAF officers received temporary promotions to major general and 17 colonels were advanced to the temporary rank of brigadier general by President Truman last week.

The new major generals are: Albert Boyd, commander of the Wright Air Development Center; Leigh Wade,

one of the original 'round-the-world Army pilots and now Air Attache in Brazil; Delmar T. Spivey, commander, Japan Air Defense Force; John K. Gerhardt, deputy director of Air Staff Operations; Garland E. Blair, commander, AACS, MATS headquarters; Charles E. Landon, director of Statistical Services, USAF headquarters; Lee B. Washburn, director of Installations, Air Staff; James McCormack, Jr., deputy commander ARDC.

The new brigadier generals are: Ralph Fisher, chief of USAF Section, joint military advisory group in Europe; Woodbury M. Burgess, deputy for intelligence, Air Defense Command; Alvord V. Anderson, Jr., deputy commander, Warner Robins Air Materiel Area; Glynne M. Jones, commander, 63rd Troop Carrier Wing TAC; Alfred F. Kalberer, commander, 72nd Strategic Reconnaissance Wing SAC; Ethelred L. Sykes, Benjamin Webster, and George S. Cassaday, all attending the National War College; Karl Truesdell, Jr., chief of staff, standing group NATO, Washington, D. C.; Joseph D. C. Caldara, commander, 55th Strategic Reconnaissance Wing, SAC; Albert T. Wilson, Jr., commander, 1807th AACS Wing, MATS; Ira D. Snyder, deputy chief of Staff, Materiel TAC Headquarters; Estes M. Howell, Jr., commander 12th Air Division, SAC; Joseph J. Nazzaro, commander 68th Strategic Reconnaissance Wing, SAC; Stanley J. Holtoner, commander, USAF Flight Test Center, Edwards AFB; John D. Stevenson, commander, 49th Air Division, USAFE; T. Allen Bennett, commander 25th Air Division, ADC.

Aviation Safety

Engine Failed On Crashed Airliner

A Cubana DC-4 that plunged into the choppy Atlantic just outside the sheltered waters of St. George's Bay, Bermuda, had an engine failure immediately after takeoff, survivor reports showed.

Meanwhile, U. S. Coast Guard reports say the airplane "crashed with great force," rather than making a normal controlled ditching. The crash and explosions loud enough to be heard on shore are believed to have injured or killed many of the 37 passengers and crew members who were lost. Virtually all of the 17 bodies recovered by rescue boats showed some signs of crash injury.

Steward Orlando Lopez Suarez and three women passengers survived. Suarez reported he noted "one of the left engines lost its revolution and we were unable to gain altitude" after the takeoff.

The steward, only surviving crew member, kept one woman passenger from drowning until U. S. airmen pulled them both aboard a Kindley Field crash boat.

Capt. Louis Sastre, who piloted the plane, was described as one of the airline's best and most experienced pilots. The plane had landed at Bermuda's Kindley Field, en route from Madrid to Havana.

It crashed while taking off to continue to Havana.

The airplane, called Star of the East, was owned by the Cuban Aviation Co., a Pan American World Airways affiliate.

The U. S. Coast Guard Cutter Yakutat, three Martin PB4M Navy patrol bombers and a USAF SB-29 rescue plane, were on the scene. Principal aircraft rescue contributions were in lighting flares and in dropping life rafts to the struggling survivors, who could not be reached immediately by the surface craft because of burning oil and gasoline.

Group Will Study Avionics Reliability

Important appointments to emphasize study of reliability of electronic equipment have been made by the Defense Dept.

Among these Lewis M. Clement of the Crosley division, Avco Manufacturing Corp., Cincinnati, has been named chairman of the recently formed Advisory Group on Reliability of Electronic Equipment and Frederick J. Given, Sandia Corp., Albuquerque, and Stuart L. Bailey, radio engineer, Washington, D. C., were named as members of the group.

Consultants to the group are Joseph A. Chambers, Phoenix Motorola Research Laboratory, Phoenix, and Albert F. Murray, radio engineer, Washington, D. C., each of whom at one time served as chairman of a similar former group.

The Armed Services are represented by S. M. Thomas, Office of the Assistant Secretary of the Army; Capt. F. R. Furth, BuShips, Chief of Electronics, and Lt. Col. Lloyd C. E. Urquhart, Headquarters, USAF. Joint Chiefs of Staff are represented by Col. David S. Woods, and K. A. H. Smith is representing the Munitions Board.

Another top-level appointment was that of Henry Randall as executive director of the RDB Committee on Electronics. Before his connection with the RDB Committee Randall was associated with the Picker X-Ray Corp.'s offices in New York, Washington, Boston and Cleveland.

NEW ITALIAN TRAINERS COMPETE

Here are Piaggio P.150 (top photo) and Fiat G.49 (above) two-place trainers designed for a new Italian Air Force competition, which includes the Macchi M.B. 323 (Aviation Week Dec. 8, p. 17). The P.150, which recently started flying, is powered by a 600-hp. P&WA R1340-S3H1, is of all-metal construction and has a top speed of approximately 150 mph. at 5,000 ft. Its gross weight is 5,600 lb. The Fiat G.49 is powered either by a 550-hp. Alvis Leonides 502 or a 600-hp. P&WA R1340-S3H1. Gross weight is 5,500 and 5,800 lb. respectively, depending on engines. Top speed with either of the two available engines is approximately 145 mph.

Korea Air Fight

- **Red air targets becoming scarce, Vandenberg says.**
- **Communist pilots hide at Manchurian bases.**

The U. S. Air Force in Korea now is being used largely for close support of ground troops because few good air targets are left behind the Communist lines, Gen. Hoyt S. Vandenberg, USAF Chief of Staff, said after his recent 'round-the-world inspection trip.

"The Air Force has destroyed all actually good air targets in Korea with the exception of lines of communication," Gen. Vandenberg said. "The Air Force is now being utilized as a supplement to the artillery.

"Looking back on my World War II experience, it is rather unusual to see an artillery gun putting down a white phosphorous shell to mark where the Air Force should utilize its bombs as artillery. That is what actually happens in Korea now. The enemy guns and mortars are dug way down. The guns are in caves. They fire two rounds and then pull back in. The mortars are several feet underground.

"The Air Force is using heavy bombs to try to cave these in. It is not a very lucrative target. Sometimes we send a mission out where we have discovered four or five small huts and we have reason to believe there is a concentration of Chinese or North Korean personnel, perhaps a headquarters or a billeting area. Outside of the lines of communications, that's probably the biggest air target of value that's left in North Korea."

▶ **New B-26 Tactics**—Vandenberg said that Gen. James Van Fleet, 8th Army Commander, and other Ground Force leaders assured him that aerial attacks on the Communist supply lines had made it impossible for the enemy to mount or sustain a major offensive.

Although the Communists were able to fire 650,000 rounds of artillery in October, Vandenberg said it represented an average of only 100 ammunition trucks reaching the front lines every night. He said new tactics used by USAF B-26 light bombers against Communist night truck traffic were proving very effective.

Vandenberg also said the Communist jet bomber force, previously reported by Air Secretary Thomas Finletter as located in Siberia, had been transferred to Manchuria. He said Chinese pilots presumably were being trained there in the Communists' new IL-28 twin-jet bomber, an aircraft roughly comparable in performance to the British Canberra. Secretary Finletter had estimated 300 to 400 of the new jet bombers had been transferred from Russia to Siberia earlier in the fall.

"It is apparent to me that the pattern of the Chinese Communists—similar to that of Soviet Russia—is to modernize their air equipment, and I believe this is being done in Manchuria," Gen. Vandenberg said.

▶ **Fewer Pilots**—He also noted a decline in the quality and aggressiveness of MiG-15 pilots during recent months.

"There are fewer and fewer Communist pilots that seem to come out aggressively," he said. "Initially there was a period when they would go slowly for a week or two, gradually building up. Then when they apparently got enough training, they would tangle with our pilots. This was done with a great deal of spirit and quite great numbers.

"Now we find that even in that period when they will venture into combat they don't stay very long if they are not in a position to leg it back across the Yalu pretty quickly."

New Safety Record

U.S. scheduled domestic airlines now probably have the best safety record in terms of passenger miles in their history, new Air Transport Assn. statistics show. These figures reveal that the passenger fatality rate per 100 million for the 12 months ending Nov. 30, 1952, was down to 0.37, or about one fatality for every 300 million passenger-miles.

Plan Copter Base

Rick Helicopters, Inc., of Los Angeles is negotiating with the San Francisco city officials for rental of space at the municipal airport to build a $150,000 maintenance base for its 20 copters.

The new base would serve as a springboard for proposed helicopter and mail service between San Francisco and several towns in northern California. Rick Helicopters has filed an application with Civil Aeronautics Board.

James S. Ricklefs, owner of Rick Helicopters, Inc., has purchased from Elmer Schlesinger all outstanding stock of U.S. Helicopters, Inc., doing business as Helicopter Services of California and Hawaiian Helicopters.

French Pioneer Dies

Maurice Prevost, French pilot and aviation engineer, died in Paris, Nov. 27. He was 61. He learned to fly in 1910. Since 1929 Prevost headed Esso aviation marketing interests in France.

Anti-Sub Copter

- **First test flight of Bell XHSL-1 expected Jan. 1.**
- **Sub-hunter will operate off Navy cruisers.**

First flight of the three-ton Bell XHSL-1 anti-submarine tandem-rotor helicopter is due about Jan. 1 at the Bell Aircraft Corp. helicopter plant near Ft. Worth, Tex.

The copter is powered by a Pratt & Whitney R2800 engine and is designed to carry search radar plus enough armament to dispose of any submarine it may locate. It operates at slow speeds with relatively long range for a rotor-craft.

Exact power rating of the copter's R2800 powerplant has not been disclosed, but various models in conventional aircraft have ratings of 2,400 to 2,500 hp. The P&WA engine will make Bell's XHSL-1 the most powerful single-engine helicopter yet developed in this country.

▶ **First Shipboard Copter**—The first shipboard helicopter specifically designed for anti-submarine work, it will be ready for tactics already studied with smaller copters. The XHSL-1 is expected to be pushed rapidly through its first flight phase and delivered to the Navy for later evaluation of its sub-hunting capabilities in the Gulf of Mexico.

The Bell machine is the manufacturer's first venture into tandem-rotor configuration. It bears a general resemblance to the Piasecki Flying Banana. The copter uses the Bell rigid two-blade rotor system with stabilizer bar below the rotor, standard on smaller Bell machines. Control is obtained, not by a smaller anti-torque rotor, but by varying the torque of the two equal diameter rotors against each other.

Fixed landing gear provides dual wheels, on each side about two-thirds of the way back on the fuselage, indicating the center of gravity is near this point. Single wheels are on each side near the nose.

To compensate for shipboard space limits, the XHSL-1 has folding blades and two rotor heads at the extreme fore and aft points of the fuselage for maximum blade diameter. The copter is designed for use on cruisers and other medium-sized ships, as well as on small carriers.

▶ **Commercial Development**—Bell is known to be considering plans for commercial development of this helicopter or one of similar size to carry 20 or more passengers as a transport with a cruising speed of about 120 mph.

Most of the first machine was produced at the Bell plant in Buffalo, N. Y.

Major assemblies have been shipped to Ft. Worth for final assembly, now virtually complete, in preparation for first flight test, as forecast in AVIATION WEEK (Nov. 12, 1951, p. 11). Subsequent HSL-1 machines will be manufactured at the Texas plant.

Austerity Again Hits British Air Industry

By Nat McKitterick
(McGraw-Hill World News)

London—British plane makers lost a big cushion of indicated forward buying last week with the announcement of extensive economies in Britain's air rearmament.

The government tried to put a good face on the whole thing by talking of accent on quality rather than quantity—better defense for the same or less money (AVIATION WEEK Nov. 24, p. 15). But the hard fact remains that Britain again is unable to afford a modern air force without facing the prospect of bankruptcy.

The cuts mean that Britain's defense spending on new aircraft, engines and spares next year will not increase much above this year's $310-million estimate (the figure given for new production only).

Despite the cuts, however, industry expects an increase of 10,000 in its labor force in the next year for military and civil types.

▶ **Trainers Unaffected**—Forward buying for the following craft have been cut back sharply: Canberra, Venom FB.1 fighter-bomber, Meteor and Vampire fighters, Balliol and Varsity piston trainers, and Percival Pembroke light transport.

Meteor and Vampire jet trainers were unaffected. Nor do the cuts apply to the Venom night fighter or any naval craft.

Canberra subcontractors—Avro, Short Bros., Handley Page—are to continue small initial orders, in the neighborhood of 50.

But no further orders are going to be placed. The hope is that Canberra cutbacks may bring on a quicker superpriority for Vulcan and Valiant medium bombers. But Vulcan orders placed still number less than two dozen, while about 50 Valiants are at present on order.

It is also hoped that superpriority for fighters—the Gannet, Hunter, Swift and Javelin—can be brought on faster by extending subcontracting work to firms affected by the cuts.

At the same time the distinct possibility exists that civil types—Viscount, Comet and Britannia—will be given superpriority status.

REPUBLIC XF-91 has four Reaction Motors rockets above and below J47 tailpipe.

Rockets Push XF-91 Past Mach 1

First supersonic rocket-powered flight by a U. S. combat-type plane has been made by the Republic XF-91, Mundy I. Peale, Republic Aviation Corp. president, announced last week.

A Reaction Motors engine with four rocket motors of 1,500 lb. thrust each, supplied a total of 6,000 lb. thrust to add to approximately 8,000 lb. thrust from the plane's General Electric J47 turbojet engine with afterburner.

Peale described the plane as "a combat-ready airplane, not purely a research plane, and as "a bridge of the gap between jet and rocket planes."

Reliable industry sources have stated that the XF-91 is capable of speeds in the neighborhood of 1,000 mph. using its rocket power.

▶ **More Flights**—The first supersonic flight was followed by additional high-speed runs at Edwards AFB, Calif., with Republic test pilot Russell (Rusty) Roth at the controls. The plane is continuing a research rocket flight program there.

The XF-91 has inverse taper wings with wider chord at the tips than at the fuselage. These are swept back at about 35 deg. and have variable incidence to provide a high angle of attack for takeoff and landing, and a low angle for high speeds.

Inverse wing taper with leading edge slats, makes possible flight at speeds lower than usual with jet fighters.

▶ **Flown to Desert**—The experimental airplane was airfreighted to Edwards AFB in April 1949 and made its first flight using the J47 only on May 9, 1949.

A series of turbojet-powered flights were then made to demonstrate low stall speed characteristics and wing incidence variations were operated through their complete range in flight.

Reaction Motors provided the rocket powerplants which are now installed above and below the jet engine exhaust.

Two U. S. rocket planes which have previously flown faster than sound, the Bell X-1, and the Douglas Skyrocket D-558-II, also are powered by Reaction Motors rockets. These planes, however, are strictly research types.

The XF-91 has been through a modification involving installation of the afterburner, and installation of a sharply pointed extension of the horizontal tail.

Japan Air Expansion Plans Are Outlined

(McGraw-Hill World News)

Tokyo—Plans for a three-year program to promote and build up Japanese commercial airlines recently were completed by the transportation ministry. A government loan of $2.5 million to the existing Japan Airlines Co. will help.

During the first year the plan calls for four overseas routes, using two Douglas DC-4Es and two DC-6Bs: Tokyo-Pusan, and Tokyo-Taipei, twice a week each; Tokyo-San Francisco and Tokyo-Karachi, once a week each.

Plans for the second year call for addition of two more Douglas DC-6Bs and the extension of all three international routes. The San Francisco route will be extended to Rio de Janeiro; the Karachi route to London, and the Pusan service to Seoul. Three new domestic routes will be opened with addition of nine more D-18s.

During the third year, in addition to opening new routes to Singapore and Batavia, more flights each week are planned for the then existing overseas routes British Comets are expected to be used on the Tokyo-London run in 1955. Two new local routes are planned, using three additional twin-engine planes.

CESSNA 170 is one of three models on which company is building its 1953 campaign.

Cessna Opens 1953 Sales Drive

By Alexander McSurely

Wichita—A new version of Cessna Aircraft Co.'s best selling airplane of 1952, the four-place Model 170, is headlining the company's "Golden Year" sales program for 1953, commemorating the 50th anniversary of powered heavier-than-air flight.

Two other airplanes, the 190 five-placer and a newcomer soon to be announced, will complete the Cessna line for 1953. The 1953 program was announced at a "kickoff" meeting and dinner conducted here by Dwane Wallace, Cessna president, and Bob Chatley, sales promotion manager.

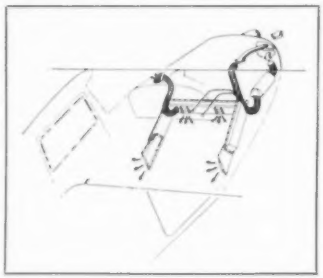
Citing 1952 as the biggest sales year in Cessna's history, with sales more than double last year and with Cessna distributors and dealers dividing more than $3,866,000 in commissions on new planes and parts, company leaders pointed to an even greater sales potential expected next year. Individual Cessna franchises were worth an average fee of $60,000 to distributors in 1952, and some are expected to be worth as much as $250,000 in 1953, they stated.

Cessna attributed the rapid growth of sales in the last year and expected continued growth to utility of Cessna planes as business vehicles, plus a sales program concentrated on demonstrating business utility.

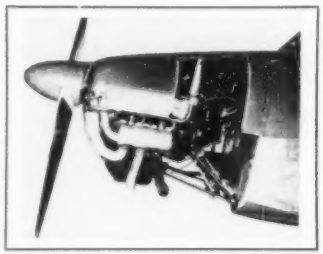
▶ **Model 180**—Cessna made its new "sales pitch" to distributors individually, calling in each of the 50 present to outline the 1953 program. Early in January, all will return to Wichita for a general sales session.

The new 1953 airplane previously has been identified in AVIATION WEEK as the Model 180, powered with a Continental E225 engine. Other details of this airplane will be announced shortly.

Another new Cessna airplane, previously referred to in AVIATION WEEK as the Model 310, is still in development and will not be included in the 1953 sales program. It is expected this will be the twin-engine business liner which Cessna already has told its dealer organization will be added in the "near future." Additional details on this plane also are expected to be announced soon.



ONE-UNIT heating-ventilating duct on 170.



QUICK-REMOVE engine cowling of 170.

Cessna officials made it plain that the five-place 190 series would continue as an integral part of its line for years to come, pointing out that it was without direct competition.

▶ **New Features**—Sales on the 1952 Model 170 were closed in October, since the year's production was then sold out, Wallace explained.

Here are some new features of the 1953 Model 170:

• **New shock-mounted** redesigned instrument panel, lighted from a new system in the cabin ceiling, distributing even light over all instruments.

• **New heating and ventilating** unit providing 70% more heat, with six large air outlets in the cabin and a single control.

• **New landing and taxiing** light system, located in the left wing.

• All-metal McCauley propeller, now a standard item on the airplane, is "slicked up" with a new propeller spinner and a new stylish paint job, distinguishing the airplane externally from its predecessors.

Time-proven features such as the "para-lift" flaps, adapted from those used on Cessna's slow-flying L-19 Army liaison plane, and the six-cylinder Continental 145 hp. engine which has been standard on all the 3,400 Model 170s previously sold will be continued. Price-wise the 1953 Cessna line starts at $8,450 with the Model 170 standard, equipped, and runs up to $21,750 for the model 190, with the new Model 180 included somewhere between.

Pre-Flight Training Goes to Lackland

Revamping of Air Force pre-flight training to center at Lackland AFB, Tex., by last month will mean a shift in status of the nine civilian-operated primary flight schools and the USAF-operated Goodfellow AFB Primary Flight School. Heretofore pre-flight training has been given at the primary schools.

New program provides for a class of 1,200 cadets to report each six weeks for 12 weeks of pre-flight at Lackland. Then they will move on to flight training at the 10 flight schools, enabling the students to fly approximately 193,000 hr. every six weeks for approximately the cost of the 155,000 hr.

They now fly in North American T-6s. This will be made possible in part by use of 90-hp. tandem Piper light trainer planes for the initial phase of flight. The students each will fly 145 hr. instead of the present 130 flight hr. they now receive in 24 weeks at primary flight schools. Use of the Piper trainers is expected to begin some time next spring, probably around Feb. 15.

The new arrangement is expected to delay plans for opening any additional civilian contract primary schools until existing schools take up the slack made by shifting pre-flight to Lackland.

New Israeli Airport

(*McGraw-Hill World News*)

Tel Aviv—A large airport will be built at Haifa, north of the present air terminal, to provide alternate landing facilities when bad weather closes in Lydda airfield. Also, $50,000 is to be spent improving the Elath (Red Sea) air strip.

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WEIGHT

Greater output per pound is the constant objective of the aircraft designer. EEMCO serves this goal by turning out new electric motors with increased power, decreased weight and all the required operating characteristics. This tough new lightweight for driving a compressor was built to the latest Army and Navy specifications. Operating on 27 volts D.C., it provides 3 horsepower under continuous duty at sea level, $2\frac{1}{2}$ h.p. at 50,000 feet with duty cycle of $\frac{1}{2}$ hour on—$\frac{1}{2}$ hour off. It weighs only $13\frac{1}{2}$ pounds with integral gear box of $2\frac{3}{4}$ to 1 reduction.

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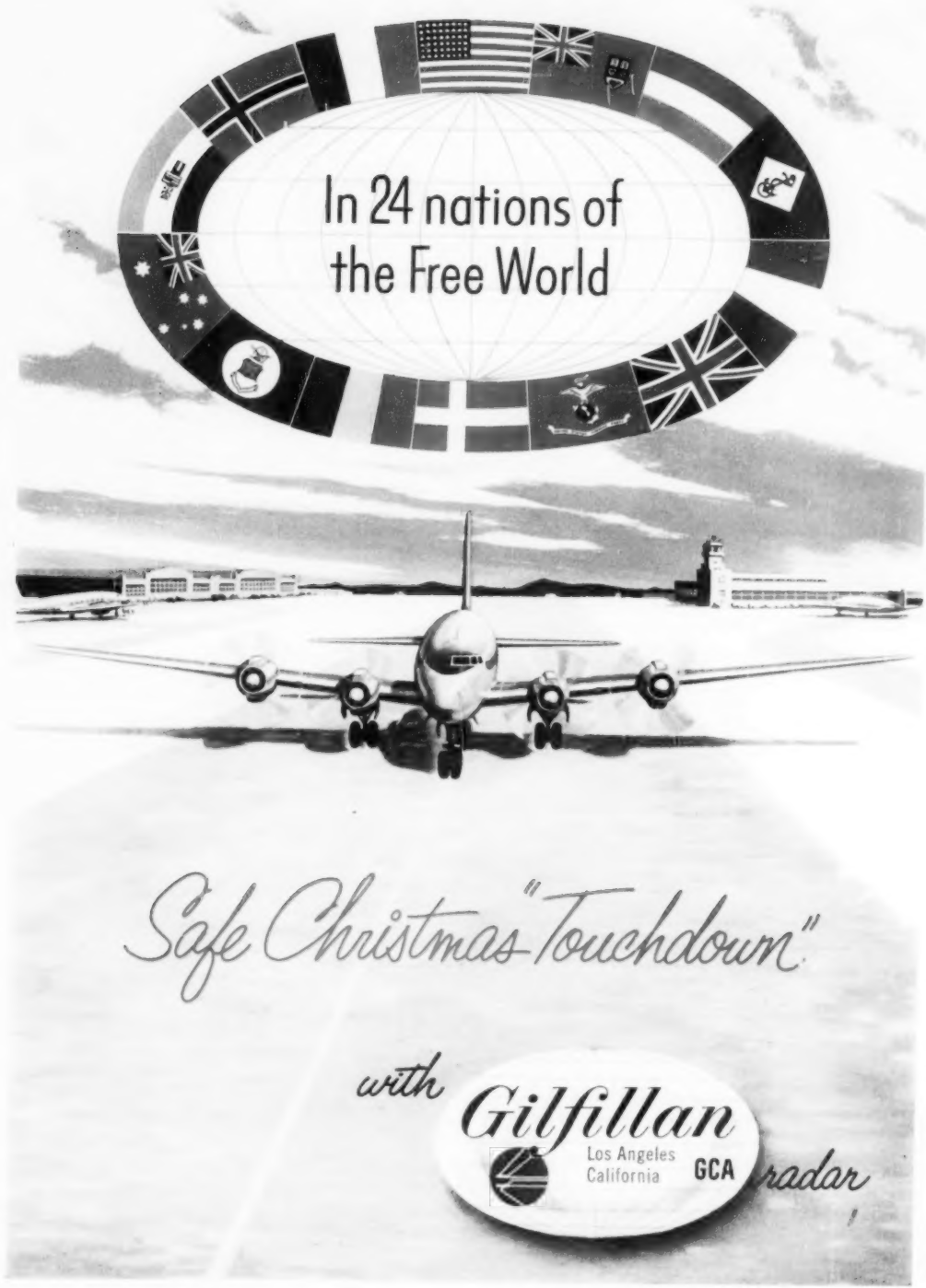
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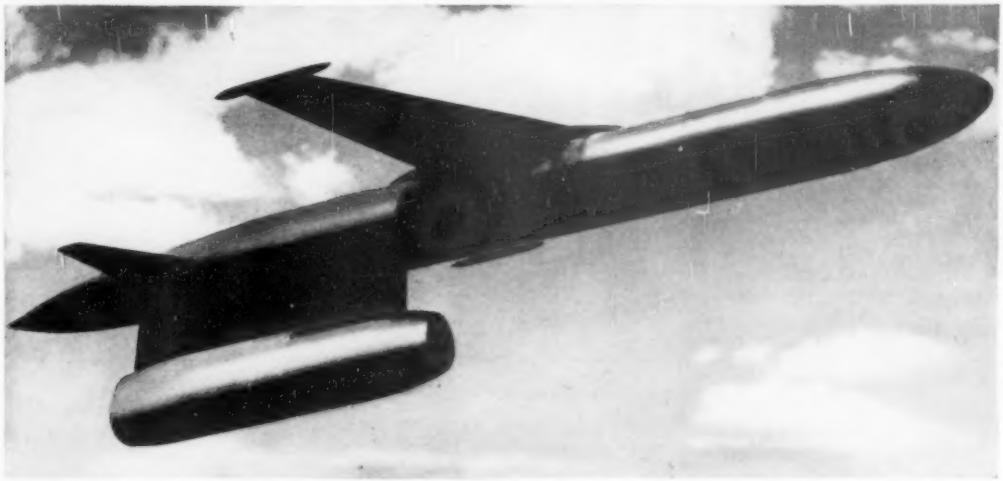


MARQUARDT RAMJET powers Martin's KDM-1 target drone. Although speed in this case is subsonic, Navy likes engine's low cost.

Ramjet Favored for Mach 2-4 Range

- **Engine promises high thrust for little fuel**
- **Because it is simple, it should be reliable.**

The ramjet is a powerplant with enormous potential. In the Mach number range between 2 and 4, it offers, compared with all other air-breathing power plants:

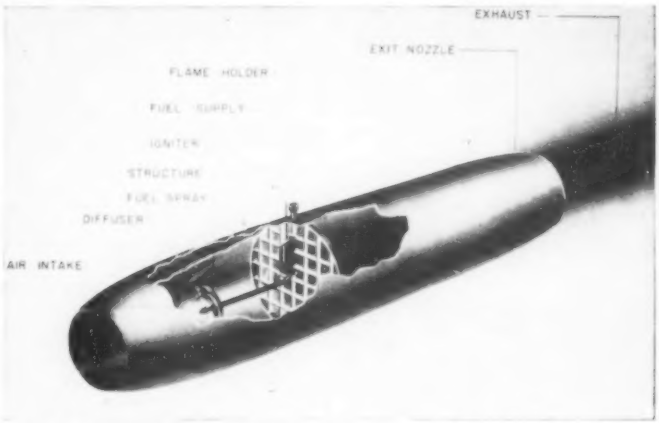
- **Minimum specific fuel consumption.**
- **Maximum thrust-weight ratio.**
- **Minimum initial cost per horsepower.**

Its basic simplicity pays off in maximum potential reliability.

The ramjet may provide propulsion for aircraft in speed and altitude ranges much greater than those explored by man during the past half-century. In this respect it may be inferior only to rocket motors utilizing nuclear energy.

Authority for these statements is Malcolm Harned, chief designer of Marquardt Aircraft Co., the only engineering and development firm known to be devoted exclusively to ramjet problems.

Harned's views, recently presented at the seventh annual convention of the American Rocket Society, in a paper, "The Application of the Ramjet to Aircraft Propulsion," deal with a subject long and thoroughly hidden from public scrutiny by the shroud of security.



SIMPLE CONSTRUCTION and few moving parts are two features of the ramjet.

Where do we stand today on ramjets? Within reasonable security bounds, here is what Harned has to say about this powerplant.

▶ **Operation Cycle**—In spite of its simple appearance—which has led to the misnomer of "flying stovepipe"—the ramjet goes through the same kind of cycles as other types of air-breathing engines.

Air is scooped in by the forward motion of the engine, is compressed in the diffuser where fuel is added, is heated by combustion downstream of the flameholder and then expanded through an exhaust nozzle to produce a high-velocity jet.

What makes the ramjet unique is that compression comes from the drive of the engine through the air, obtaining ram compression. This eliminates the need for a moving compressor within the engine.

(Another kind of powerplant, the turboramjet, adds a turbojet as an air compressor between the diffuser and the

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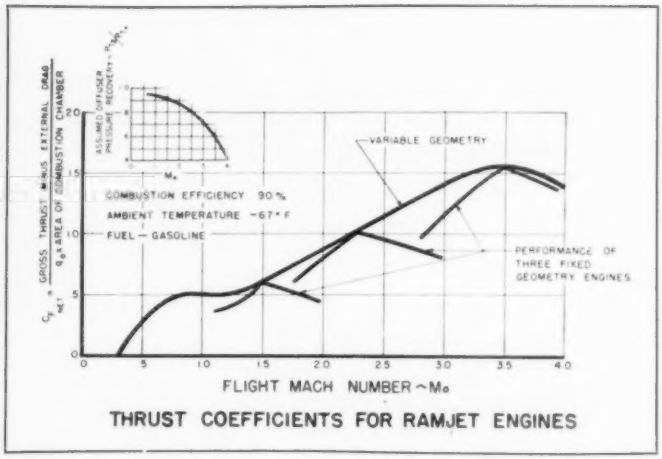


THRUST COEFFICIENTS FOR RAMJET ENGINES

combustion chamber to provide static thrust.)

Using forward motion for compression does two things:

• **It defines the efficient speed range.** Compression ratio largely determines thermal efficiency of any internal-combustion engine, and in the case of the ramjet, a Mach number of about 2.0 is necessary to achieve pressure ratios competitive with other engines (about 7 to 1).

• **It makes starting difficult.** Instead of whirling a starter, the whole engine must be moved to speed sufficient to start operation.

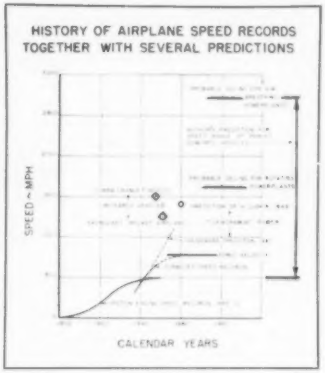
► **Five Factors**—Harned says that to examine the potential of the powerplant, you consider five factors: performance, requirements and serviceability.

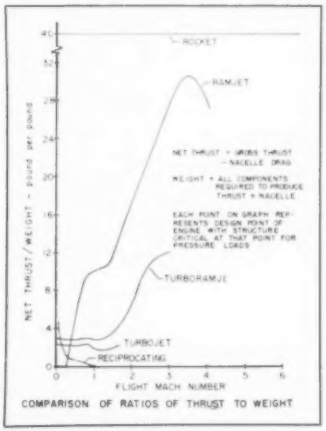
Performance, he says, is the first criterion, and has become doubly important since the achievement of supersonic flight. Power requirements are many times greater than can be met with the largest other engines today; and weight of the installed engine is much more critical.

Harned presents some generalized calculations of power available for a given weight, based on Marquardt's ramjet experience. These results, plotted as curves, show that from Mach 0.6 on up, the ramjet is better than all powerplants except the rocket. The comparison considers all engines in complete nacelles, with necessary fairings, diffusers, propellers or whatever is necessary to produce thrust.

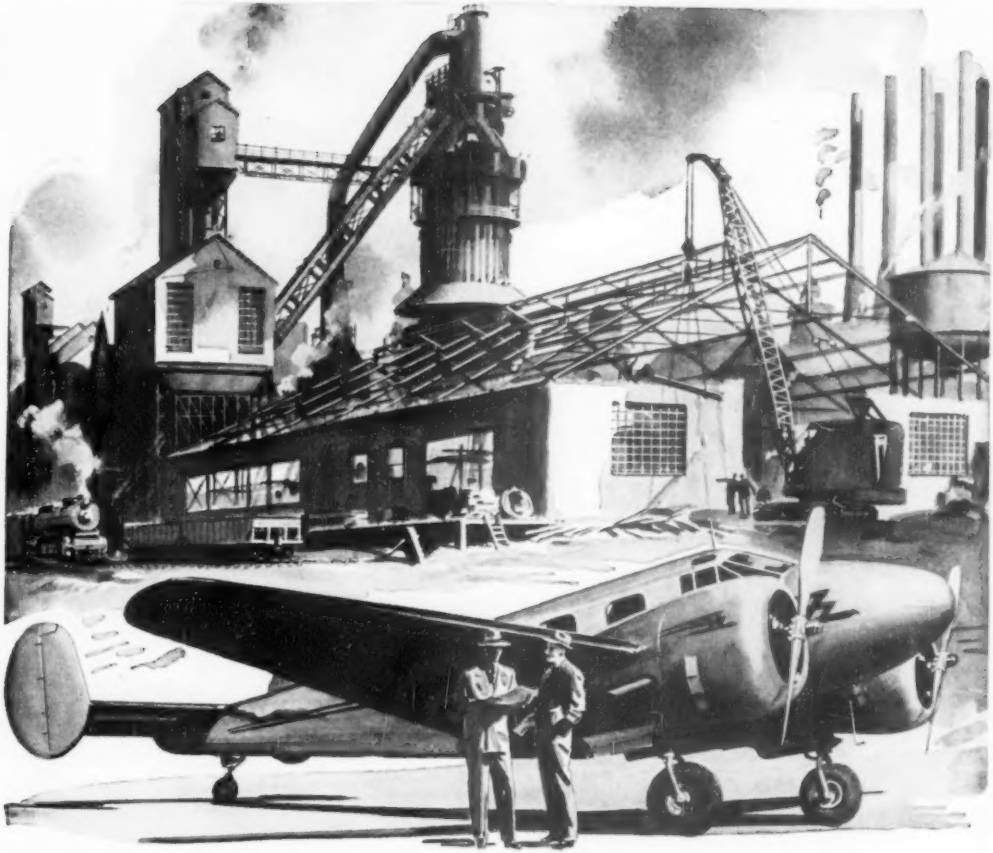
For completion of the performance picture, Harned shows the curves of specific fuel consumption. At low Mach numbers, the sfc. is very high, reflecting low thermal efficiency due to low compression ratio. But above Mach 2.0, the crossover point occurs, and from there on the sfc. continues to decrease.

► **Reliability**—A complete supersonic ramjet engine rated at well over 100,000 hp. can be built with only half a dozen moving parts, including the fuel pumping system and control system. None of these moving parts will be in contact





COMPARISON OF RATIOS OF THRUST TO WEIGHT



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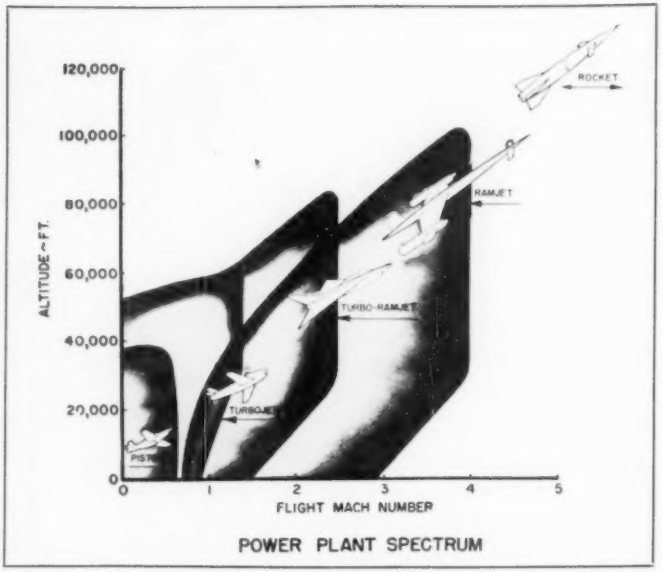


POWER PLANT SPECTRUM

with the hot combustion gases of the engine.

By comparison, a 3,000-hp. piston engine contains over 250 moving parts, and a gas turbine powerplant has about 40.

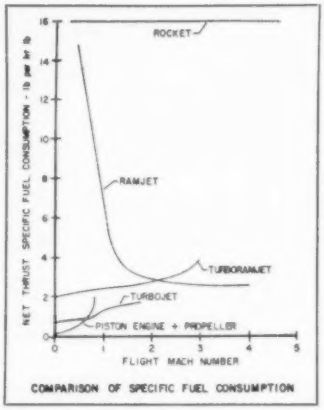
To point up the significance of the quantity of moving parts, Harned uses the assumption that an aircraft with 1,000 component parts is being developed. If these components are each subject to one failure out of a hundred operations, the overall reliability of the aircraft will be less than 0.1%. If the components are perfected so that reliability is increased to one failure out of one thousand operations, reliability is increased only to 37%. But if the number of critical components is reduced by half, then we get a 61% reliability.

In other words, decreasing the number of moving parts has a far greater effect in increasing over-all reliability, than does increasing the reliability of individual components.

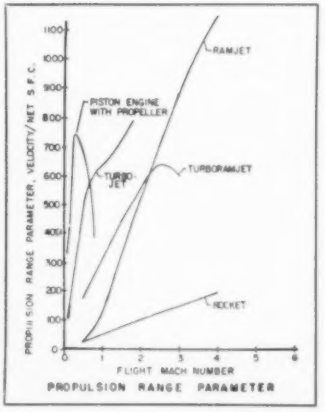
▶ **Economy**—Harned's experience has shown that all types of high-performance powerplants cost just about the same to manufacture in dollars per pound of engine weight. So, economy considerations of the ramjet are based on the amount of horsepower you get from the powerplant for one pound of engine weight.

The phenomenally high ratio of power to weight (see graph, p. 22) makes the ramjet an obvious winner here. Additional dividends result from its fuel economy above Mach 2.0.

▶ **Installation**—Harned makes a good case for the nacelle type of ramjet in-



COMPARISON OF SPECIFIC FUEL CONSUMPTION



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"Eyes of Flight" a new Rohm & Haas film used by the Air Force and Navy as an official training film on the maintenance of aircraft glazing, is now available for non-military showings. It is a 30 minute, 16 mm, motion picture in color and sound. Arrangements for use of the film can be made by writing to the Plastics Department, Rohm & Haas Company.

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stallation as opposed to an integral type. The advantages, he says, are:

- **Independent development** of engine and airframe.
- **Isolation of aircraft components** from engine vibration.
- **Easy accessibility** to engine and aircraft.
- **Engine changes can be made** without affecting the airframe.

On the other hand there may be a saving in over-all drag with the integral configuration.

Serviceability is no problem with the ramjet, because of its basic simplicity. Requirements for service are minimized because of the lack of moving parts and the simple control systems used.

▶ **Subsonic Applications**—Harned points out the limited applications of the ramjet in the field of subsonic aircraft because of the excessive sfc. at low speeds. The only places of interest are where short-time operation is needed and where high thrust-weight ratio and low cost are attractive.

This gives three possible applications: target drones, helicopters and convertiplanes.

- **Drones.** In the case of the target drone, low cost is almost the only consideration. Marquardt's subsonic ramjet XRJ-30-MA-8 engine on the Navy's KDM-1 target drone has an initial cost of about 50¢ per horsepower. This compares with a minimum of about $5 per horsepower for reciprocating engines.
- **Copters.** In helicopters, the high thrust-weight ratio is the important factor. Both McDonnell and Hiller have developed copters with this kind of engine, but Harned says that poor specific fuel consumption at subsonic speeds will always limit its usefulness in such vehicles.
- **Convertiplanes.** Most promising, the author says, is the ramjet application to the convertiplane. By using small high-speed rotors with tip ramjets for vertical flight, and propellers driven by rotary engines for forward motion, a highspeed convertiplane with good range could be achieved.

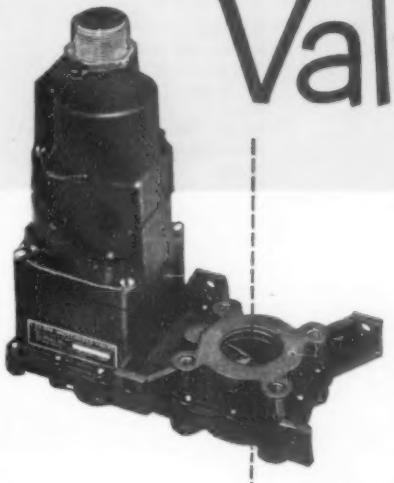
The ramjets would be used only for a few minutes at takeoff or landing, and fuel consumption is a negligible consideration.

But the convertiplane application must wait for development of a variable-geometry ramjet to reduce the cold drag—when the ramjet is not burning—to permit efficient autorotation in cruising flight. This problem is being worked on, and should be solved by the time airframe designs are available.

▶ **Supersonic Trials**—Furthest off is the ramjet transport. This is not because of any deficiency of the engine itself, says Harned, but because the operating costs of all supersonic transports are prohibitive. The most attractive configuration—assuming the necessity for supersonic

Standard-Thomson

Shut-off Valves



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- **Simple, one-direction actuator**

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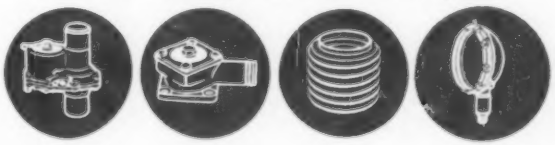

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transport—would use ramjets for cruising power and afterburning turbojets for takeoff.

For the supersonic bomber, the case is similar. Practical range will not be achieved without an aircraft several times the size of the B-36, says Harned. And so supersonic performance will probably be limited to short bursts of speed over the target area. For this kind of flight, the combination of ramjet power for emergency speed, plus afterburning turbojets for takeoff and subsonic cruise, offers a promising possibility.

Supersonic interceptors will gradually evolve from the present-day variety, powered by a subsonic turbojet. Initially the additional power required will come from conversion of the turbojet to a turboramjet, using afterburners and efficient diffusers. But when flight Mach numbers reach 2.0, ramjet efficiency overtakes that of the turboramjet.

For illustration, a simplified comparison is made for a 25,000-lb. interceptor operating at Mach 2.0. In one case, the powerplant is a ramjet plus rocket; in the other, the powerplant is a turboramjet.

- **Ramjet-rocket** craft gets to 60,000 ft. in about 2 min.; range is 210 mi.
- **Turboramjet** climbs to 60,000 ft. in 2½ min., has 190-mi. range.

▶ **Pilotless Aircraft**—Supersonic missiles offer the greatest potential for the application of the ramjet engine. Here's why, says Harned:

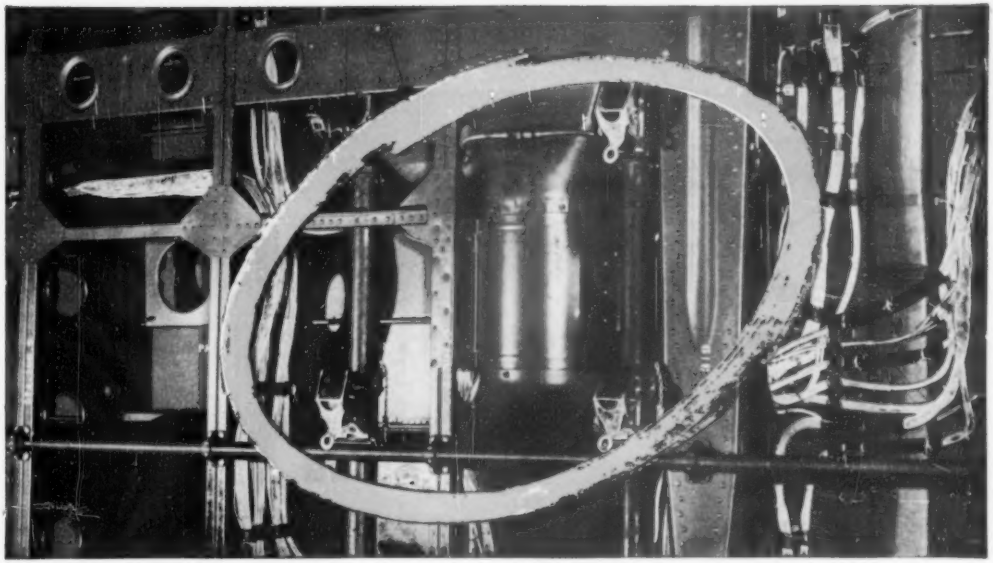
- **Speed range** will be at least above Mach 2, where the ramjet is a superior class of engine.
- **Expendable vehicles** demand low-cost components, and the ramjet is cheap to produce.
- **Fuel costs** will be negligible—less than 1/100 of the airframe cost per pound.

In air-to-air missiles, the rocket motor is most attractive for short-range applications. But where the interceptor is already flying at supersonic speeds, a ramjet-powered missile would require no boost for launching.

In long-range missiles, the most important parameter for powerplant evaluation is the speed divided by net thrust sfc. Range is directly proportional to this parameter.

In this type of consideration, the ramjet again demonstrates superiority at Mach 2 and above. In addition, from weight and cost standpoint the ramjet is also the optimum powerplant in this range.

The general requirements which will probably apply to the design of pilotless interceptors point to the use of the rocket-ramjet combination. For high thrust and vertical launching the rocket boost is almost essential. The rocket-ramjet weight is a fraction of the turboramjet weight, and the fuel cost is negligible for one-shot operation.



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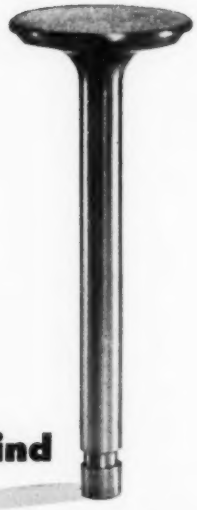

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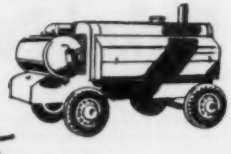

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F-84F THUNDERSTREAK prototype incorporating solid nose and wing root intakes shows what final production version will look like.

Production Details on Republic F-84F

- **New sweptwing Thunderstreak is an 80% new airplane compared with previous straightwing Thunderjets.**
- **Alternate designs were made of some major parts to insure flexibility in mass output methods.**

By Irving Stone

The first of Republic Aviation's F-84F Thunderstreaks has been delivered to the Air Force. This new sweptwing fighter isn't a simple transition from its straightwing predecessors, either design-wise or production-wise. Essentially, the F-84F is a new design.

The normal procedure with a new design would be to start with a small production rate and refine the tooling as the rate builds up. But apparently Republic has jumped into the project with both feet, taking on a high tooling load in a very limited period of time and spreading the subcontracting base fast.

This leads to the conclusion that a considerable number of Fs have been ordered—and for quick delivery—for USAF and NATO. The production knots tied by this situation appear to have been pretty well unraveled; already a good portion of Republic's production facilities is being used for making the sweptwing planes.

▶**Engine Switch**—Original plan for the F (then called the YF-96A) was to put swept wings on the F-84E and use the 5,800-lb.-thrust Allison J35-A-29 instead of the -17 engine with 5,000-lb. thrust. This model F was flown in May 1950, and the plane was planned for production under the restricted Air Force procurement of that time.

The Korean situation changed this approach. To give the plane more power, engine was switched to the Wright J65 Sapphire with 7,220-lb. thrust. The F had to be revamped to take the new engine.

Adaption of this powerplant, with its larger dimensions, to the plane, added to the airframe changes, so that ultimately the F wound up with more than 80% redesign over the predecessor E.

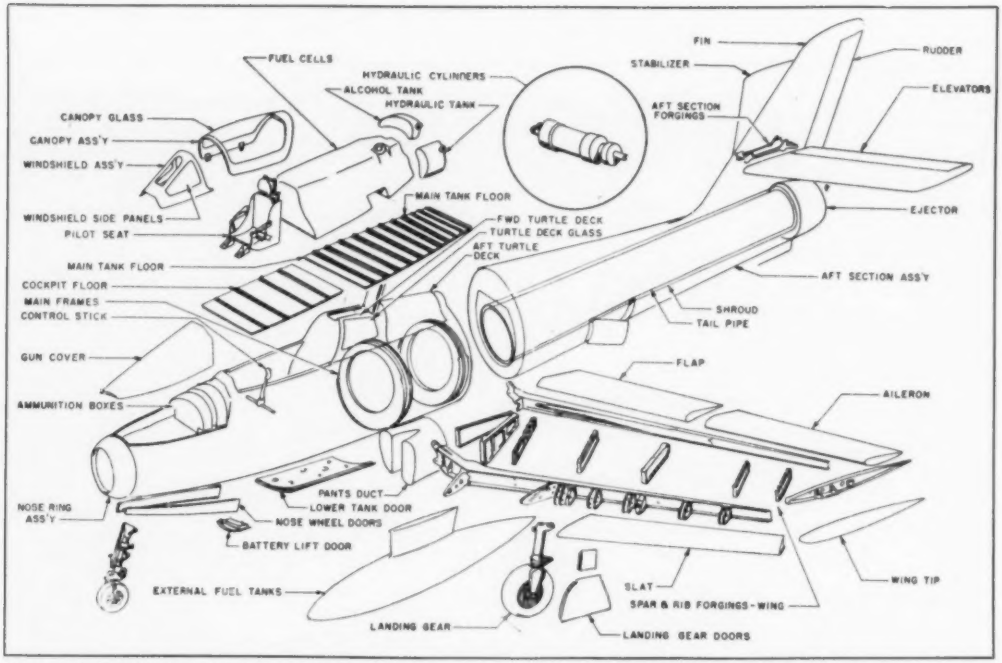
▶**Main Changes**—Some of the major changes involved in redesign were:

- **Increasing fuselage depth** by 7 in. to accommodate the larger dimensions and configuration of the Sapphire.
- **Adding larger nose** intake ducts.
- **Improving cockpit comfort** for pilot.
- **Changing cockpit canopy.**
- **Including automatic pilot** and more avionic equipment.
- **Providing for in-flight refueling.**
- **Installing leading edge slats** for improved airflow characteristics.
- **Designing the sweptwing** with a large percentage of heavy forgings instead of built-up spars and ribs.

▶**Related to Forge Plan**—Republic's decision to incorporate large forged units in the design was one of the highlights in the recent aeronautical production picture. Republic was one of the first companies to plan to design into the USAF's heavy press program.

The company's interest in heavy press forgings was not necessarily tied in with the F-84F, but when this plane was laid out it was designed for such forgings.

However, application of this design



MAIN SUBCONTRACT ITEMS are highlighted in this exploded drawing of early production F-84F, which also points up numerous forgings employed, notably in simplified wing structure. Main production effort will go to "solid-nose" model of Thunderstreak.

philosophy to the F wasn't clear sailing. Problems began to crop up that necessitated compromises.

▶**Hurdles Encountered**—First, there were the limited forge-press facilities—the only large machine in operation was the 18,000-ton unit operated for the AF by Wyman-Gordon, North Grafton, Mass. Then there were delays in phasing in of new equipment under the expanded heavy press program. Also, each large forging was an experimental program in itself, requiring uncertain development time, stemming from such factors as die shrinkage and imperfect results because of sizes involved.

There were delays in getting dies sunk, and shortage of tools was felt in getting the large pieces machined..

Then, Republic couldn't get enough time on the press because of the load imposed by the Boeing B-47 project. This situation was eased by "Operation Girdle"—the production stretchout.

▶**Two Design Schemes**—These complexities dictated a dual approach to the wing makeup, simply as a matter of precaution. In addition to designing the wing for forged components, another design was laid down incorporating built-up members. This was viewed as insurance against slowness in forging supply. (Such a parallel design effort was advanced by AVIATION WEEK July 7, p. 38, as a possible procedure even before it was known that Republic had inaugurated the scheme.)

Republic's precaution proved its worth when the 18-000-ton forge press broke down and was out of commission for about a month. In that emergency, built-up wing members were used.

Even though there are now sufficient forgings on hand to meet present production requirements, the built-up wing structures are still used in some of the Fs because there wasn't enough time for the machining subcontractor to develop machining techniques and get the necessary equipment for finishing the forged spars.

▶**Tooling Problems**—Because of the speed with which the F program subcontracting had to be gotten underway, the prime manufacturer faced many coordination problems.

Republic supplies all the master gages, not only to the subcontractors, but to General Motor's Buick-Oldsmobile-Pontiac divisions at Kansas City (which are building the F-84F under a prime contract with the Air Force). As a result of the extensive subcontracting and the technical assistance to GM, the number of master gages needed was boosted to about three times that required for a program involving normal build-up.

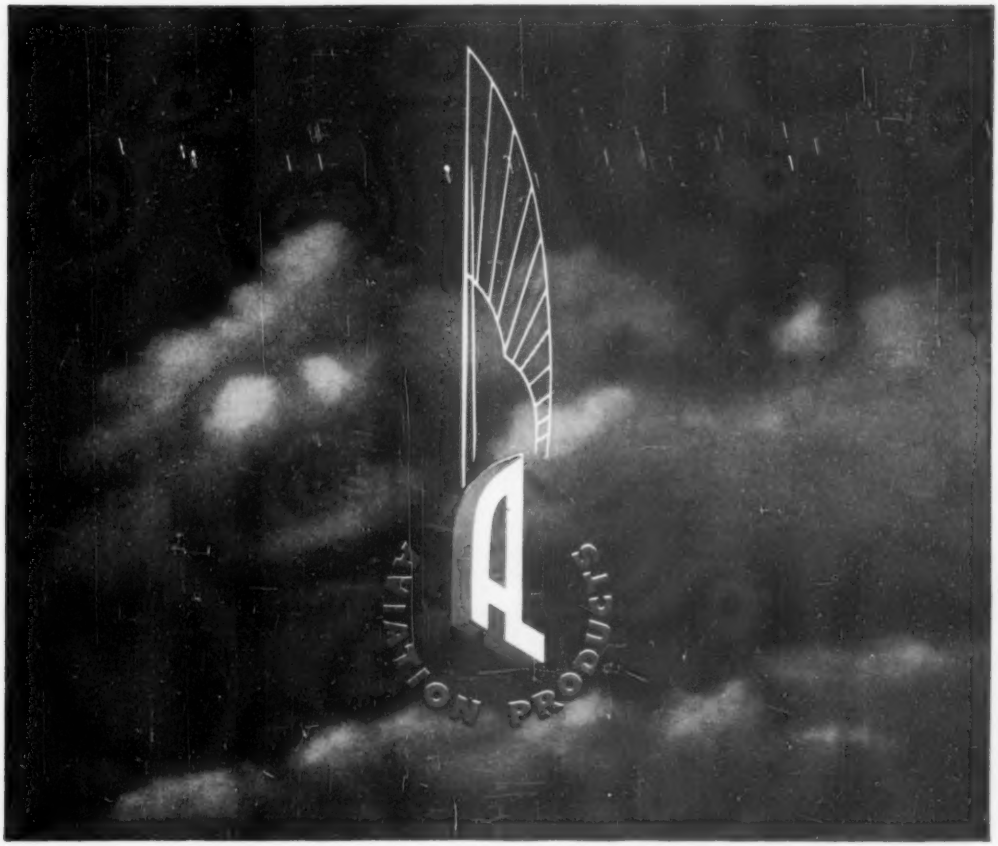
Republic didn't have the facilities to do all this master gage work at its home plant, so had to farm some of it out. Problems were involved here, too. It was difficult to get firms with sufficient know-how and equipment for this work, and teams had to be sent out to coach these master gage makers (this was also true with Republic's general tooling program). The project is now well on its way to completion.

▶**Optics in Wing Fixtures**—Optical tooling was intended to be applied on a large scale to the F-84F. But unavailability of the instruments (scopes and related equipment) as a result of the Korean war, says Republic, necessitated the application, for the most part, of conventional set-up methods instead.

However, optics were used completely for the wing assembly fixtures, and with considerable success, considering the relatively inexperienced jig builders, who had to be trained very quickly.

Republic has its own wing assembly line at its Port Washington facility, which went into operation the early part of this year. Servel (Evansville, Ind.) also is under contract to build the entire wing. Other major subs include Kaiser Metal Products, Bristol, Pa., for aft fuselage section and empennage; and Goodyear Aircraft, Akron, Ohio, for windshield, canopy and turtle deck. Republic is building the forward fuselage section.

▶**Wing Forgings**—Wing interior is



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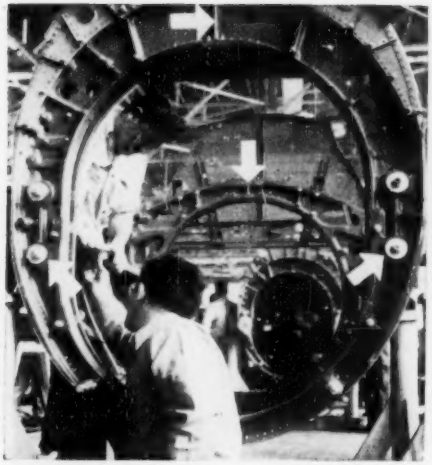
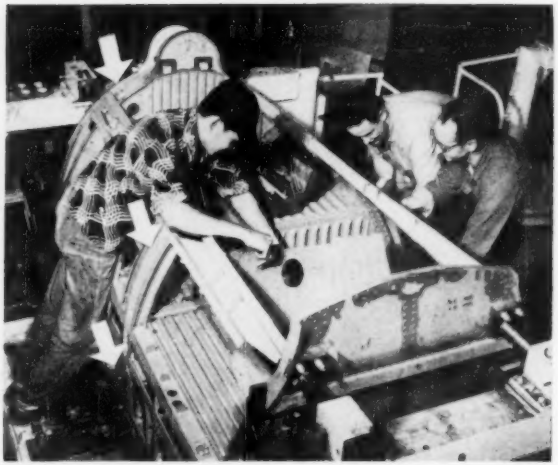
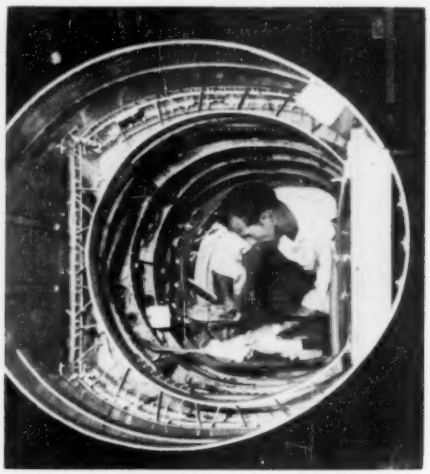


FUSELAGE frames are double units. Arrows (left, right) show attachment points for wing fittings; (top, center) splice points of frame halves.



TURTLE DECK AREA aft of cockpit. Top arrows show forward and aft main frames of the F-84F. The lower arrow indicates the jig point for wing attachment fitting.

STABILIZER of current F-84F. Later Fs will have no elevator; adjustable stabilizer will give surface control, trim.



AFT FUSELAGE looking forward, tailpipe and shroud not yet installed.

practically an all-forging job. Among the heavier units made on the 18,000-ton press are:

• **Front spar, inboard section.** This part reaches from the root to about the middle of the leading edge slat span. This spar actually comprises two forgings joined by overlapping in the web sections, with a scarf splice on the cap. Remainder of the spar is a built-up section out to the wing tip.

• **Rear spar, inboard section.** This is a one-piece forging reaching past the flap, where it is joined to a built-up continuance extending to the tip.

• **Four ribs** located in the region of the forged spar sections. Two ribs of this group, located outboard, are connected by a heavy brace forging.

• **In addition to these ribs,** another hammer-forged pair is located in the region of the built-up spar extensions. Other hammer-forgings include a group of about 14 leading edge ribs.

▶ **Wing Data**—Wing span on the F is 33 ft. 7 in. Air foil is a 10% NACA 64A010 section, normal to the ¼-chord line. Wing cathedral is 3 deg. 30 sec. Sweep on the ¼-chord line is 40 deg.

The plain flaps of the F-84E model have been retained and extend for about 50% of the panel span. Hinge line is located at 75% of the section chord normal to the ¼-chord line.

On the ailerons the tabs have been removed and there is now an irreversible power boosted control system with provisions for trimming in the system's feel cam. This trim feature would be employed only when there is a symmetrical loading due to battle damage or unbalanced stores.

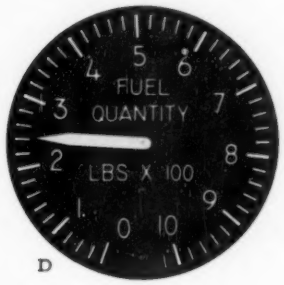
▶ **Refueling Station Change**—First air-to-air refueling provision in the F-84 series was in the G model—essentially an E with more power and other refinements.

The F-84G has been produced in large numbers as an interim plane before the F, because of the redesign required in the latter. In the G, the

A

B

C



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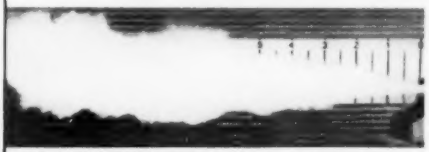
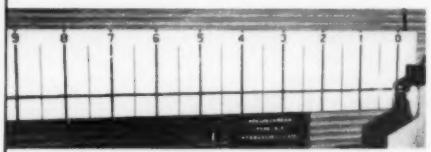


10-FOOT FLAME shoots out when a regular hydraulic fluid is forced through an acetylene torch (6300° F.) under a pressure of 3000 psi.



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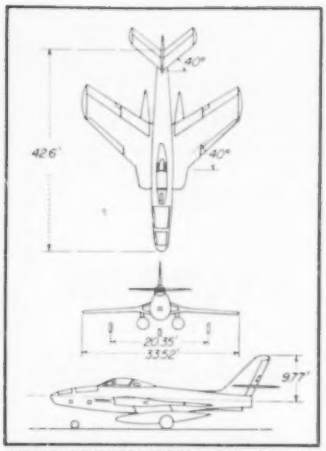
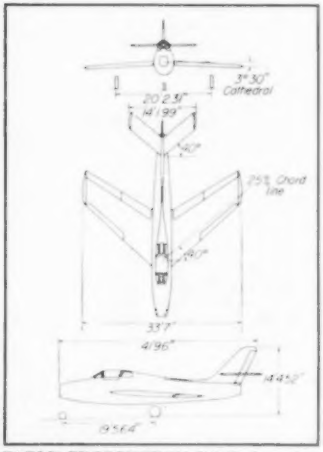


FINAL PRODUCTION F-84F three-view shows plane with wingroot intakes.



EARLY PRODUCTION F-84F three-view depicts version with nose intake.

refueling station is located in the wing leading edge area near the root. The cover doors are split chordwise and hinged at the sides, so that when opened they form a guiding trough for the refueling boom nozzle. The leading edge location was chosen mainly to avoid interference with the landing gear, and though the wing nose contour is a critical item in highspeed planes, no trouble was experienced aerodynamically with the refueling installation in this position.

In the F-84F, the refueling station is aft of the leading edge area, although still forward of the front spar, in a position dictated mainly by space available. Door design differs from that in the F-84G in that it is a single piece, rear-hinged about a line normal to the fuselage centerline, and the receiving nozzle is fixed to it. In the open position the door extends above the wing surface, carrying the nozzle with it up into the airstream.

In this design switch, the guiding effect of the doors was lost, but the nozzle mouth was flared to insure making good contact with the boom nozzle. The installation on the F-84F has been checked out satisfactorily in flight.

▶ **Wing Ducts Later**—Deepening of the air intake on the F model, from the circular opening of the E, has given greater air handling capacity. New addition in the duct is a retractable screen.

A wing location for the duct originally was made in connection with the RF-84F—a day or night photo reconnaissance version of the fighter—to get nose space for aerial cameras. Both this ship and an F are flying with the wing ducts. Trials are reported to have given such excellent duct performance that it was decided to incorporate this type of duct in the fighter at some future date (F-84Fs now coming off the line still have the nose inlet). Use of wing ducts will clear the fighter's nose to allow it to take avionic equipment, possibly radar or guns.

The wing ducts are faired into the basic wing, resulting in a deeper section. But because the chord of this section of the wing is lengthened, the wing thickness ratio is increased only very slightly. The installation requires some spar redesign. Duct portion ahead

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of the basic leading edge is tied into the fuselage structure.

► **Cockpit Cover**—Canopy on the E was the sliding bubble type. In the F model this was abandoned in favor of a hinged-arm, upward swinging type that raises the portion of the enclosure above the pilot. For normal operation it is pushed up to open. For emergency release, a button control not only causes canopy to open, but releases it from the fuselage as well. If it doesn't separate from the plane, another button sets off explosive bolts, clearing the canopy for seat ejection.

The upward-raising canopy is stronger, easier to install and better sealed than the sliding canopy. Another advantage is that equipment in the turtle deck (aft of cockpit) can remain fixed, since the deck doesn't move. In the former sliding type, the turtle deck was an integral part of the canopy, hence the deck and the equipment attached to it moved with the canopy.

► **New Fuselage Brakes**—The speed brakes on the F-84F are perforated units located on the fuselage sides just aft of the wing trailing edge. Previous F-84 models (including the G) have a single, unperforated brake on the fuselage bottom, which also doubles as a battery compartment access panel.

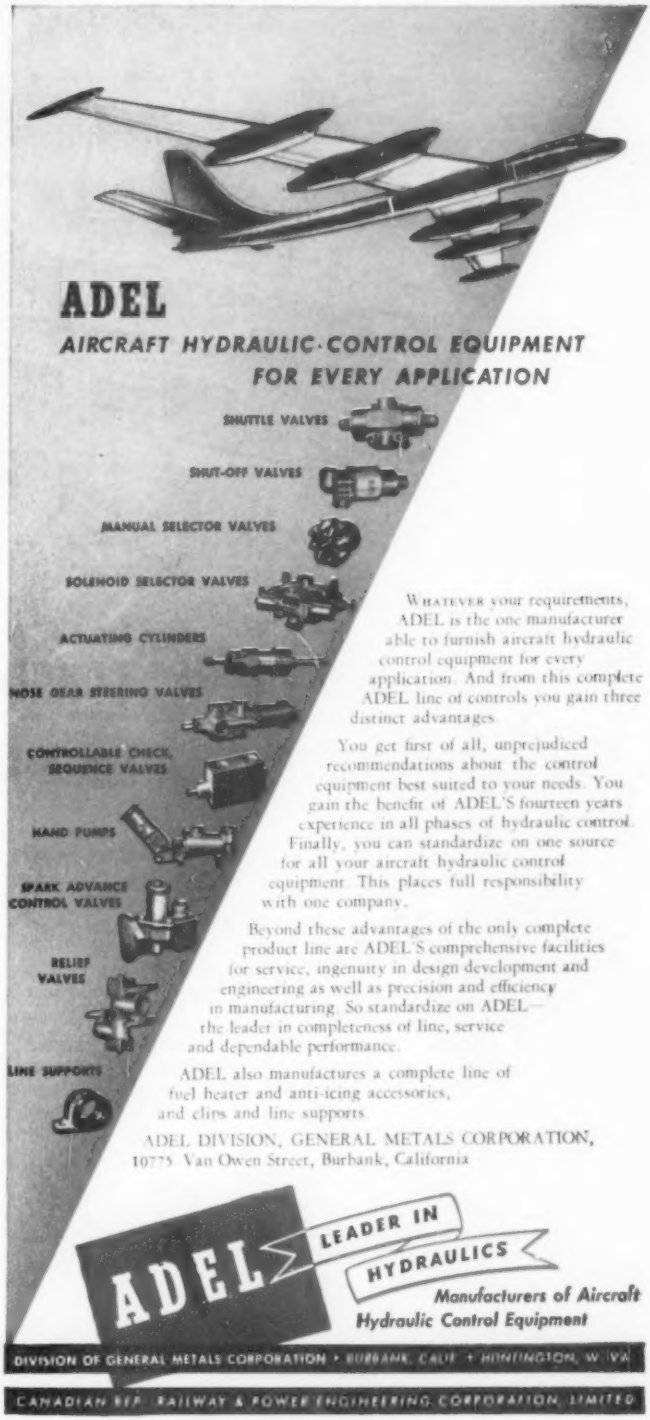
The F's brakes can be opened at any speed in the flight range up to the plane's maximum dive speed, without any large trim changes or excessive buffetting—reported to be an improvement over operating conditions with the brake on the fuselage bottom.

► **Tail Details**—Empennage of the F-84F was entirely redesigned to incorporate sweepback. The F tail design now being incorporated in initial production planes embodies a conventional elevator-type control surface with irreversible power boost, and variable positioning of the stabilizer for trim. In future production, the arrangement will be a one-piece stabilizer, with the entire surface being used for control and trim.

Actuation will change from hydraulics for the elevator and electricity for the trim, to a system of hydraulic, irreversible power boost for the entire stabilizer, plus an emergency electrical system.

A big forging in the F-84F is a combination fuselage-and-fin piece. Shape of the forging is similar to an inverted Y, with curved arms. The inverted leg serves as the lower part of the fin beam and the arms form the upper part of the aft fuselage end.

At present, the F-84G occupies most of the production area in Republic's Farmingdale facility. This plane will be phased out over a period extending through 1953, while the F model will be fed into the main line.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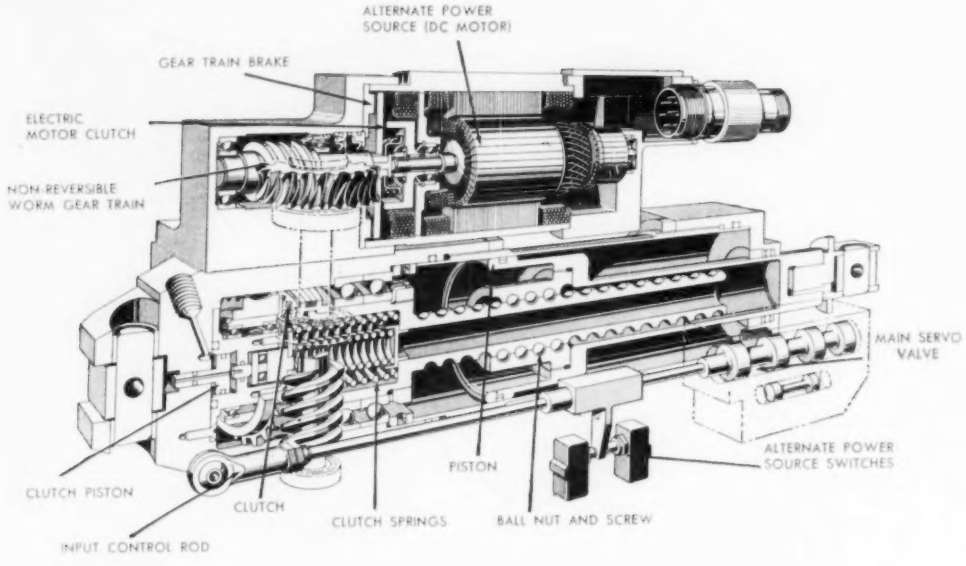
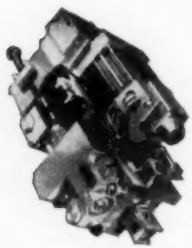


GET NEW DESIGN FREEDOM WITH AEROPRODUCTS SELF-LOCKING ACTUATORS



APPLICATIONS

- Stabilizer Control
- Jet Engine Variable Nozzle
- Dive Brakes
- Variable Wing Incidence
- Flap Actuation
- Aileron Control
- Variable Wing Sweep
- Bomb Bay Door
- Cargo Door
- Landing Gear
- Turret Control
- Canopy and Seat Control

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McDonnell F3H Horizontal Stabilizer
Others unannounced

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Computer 'Erects' Its Own VOR, DME

- **Airborne device provides course, distance data.**
- **Punched cards tune VOR stations in Collins unit.**

By Philip Klass

Cedar Rapids, Iowa—Collins Radio has a new 33-lb. airborne navigation computer which in effect creates a synthetic VOR (omnirange) station and DME (distance measuring equipment) installation at practically any U. S. airport to which a pilot might want to fly.

This arbitrary-course computer provides the pilot with visual omnirange-type steering signals, and distance to destination information, making possible instrument flight to airports which have neither VOR nor DME. The Collins computer can operate from station bearing information provided by two VOR receivers and need not await the long-promised installation of DME.

▶ **Punched-Card Operation**—Another Collins innovation is the use of a plastic version of the IBM-type card to automatically tune the two VOR receivers to desired stations along the route and to automatically set in certain data needed by the computer.

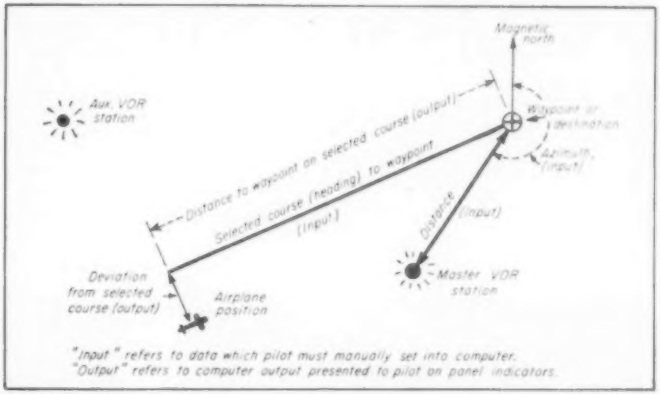
Collins thinks the punched-card arrangement will eliminate enough pilot duties and chance for human error to more than justify its slight additional weight.

▶ **What It Can Do**—The new computer and its accessories continuously show:

- Distance to a VOR station.
- Fly-left, fly-right omnirange-type steering instructions for instrument flight to any selected off-course waypoint or destination.
- Distance to this selected off-course waypoint or destination.
- Distance to touchdown during an ILS (instrument) approach, providing there is a VOR station in close proximity to the airport.

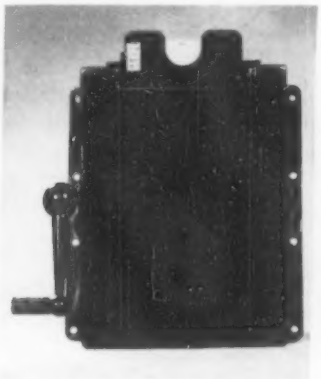
▶ **New Approach**—Offset track, or arbitrary-course computers are not in themselves new. Previous units have been designed to operate as "rho-theta" computers, using a DME distance signal (rho) and a VOR station bearing signal (theta).

The Collins device is unique because it can operate either as a conventional rho-theta computer, or as a theta-theta computer from bearing angle signals ob-

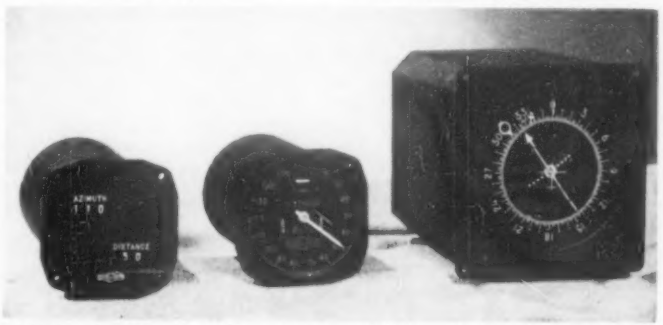

Magnetic north
Aux. VOR station
Waypoint or destination
Distance to waypoint on selected course (output)
Azimuth (input)
Selected course (heading) to waypoint (input)
Distance (input)
Deviation from selected course (output)
Airplane position
Master VOR station
"Input" refers to data which pilot must manually set into computer.
"Output" refers to computer output presented to pilot on panel indicators.

PLANE EQUIPPED with new Collins arbitrary-course computer and two omnirange receivers can fly directly to any off-course way station or destination.

COMPUTER gives pilot steering instructions and distance to waypoint.



CARD READER uses punched cards to tune VHF receivers to omni-stations.



COURSE INDICATOR (right) and distance indicator (center) present information developed by computer. Pilot sets in the coordinates of waypoint in selector (left).

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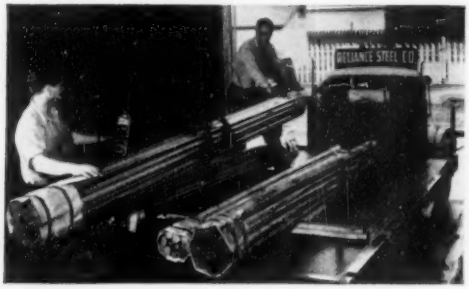

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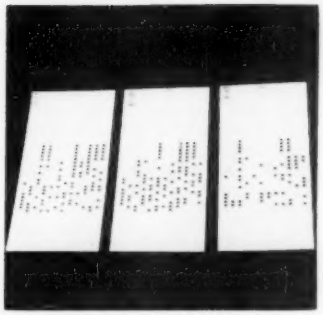

PLASTIC PUNCHED CARDS feed predetermined data into navigation computer to tune VHF receivers automatically. Card lists master station and five auxiliary stations. The card reader can be shifted from one pair of stations to another by rotating a button.

tained from two separate VOR stations.

This versatility is an important feature, Collins thinks, because most airliners are now equipped with dual VOR receivers whereas the program to install DME has moved quite slowly. However, when DME becomes an operating reality, the Collins computer can be quickly switched to operate as a rho-theta device, with only a slight weight penalty paid for such versatility.

▶ **Adds Little Weight**—The Collins computer adds comparatively little in weight and complexity to an airplane already equipped with a dual VOR receiver installation. The computer and associated accessories weigh about 33 lb., roughly half the weight of one current airborne DME equipment (which provides distance information without the arbitrary-course navigation feature).

The complete Collins installation consists of:

• **Computer:** housed in a ½ ATR rack, this unit contains four small servo systems involved in the course and distance computation. A total of 12 vacuum tubes are used.

• **Punched-card reader:** This is the device into which the plastic punched cards are inserted. It converts the coded information into required computer inputs and automatically tunes the two VOR receivers to required stations.

• **Waypoint selector:** This 3-in.-dia. panel instrument contains two knobs and two corresponding counter-type indicators. It is used by the pilot manually to set in the distance from one of the VOR stations to the desired waypoint, or destination, and the magnetic bearing (called "azimuth") of a line connecting these two points.

• **Distance indicator:** This 3-in.-dia. panel instrument gives the pilot a continuous pointer-type indication of his distance in nautical miles from the selected waypoint or destination, or from touchdown during an ILS approach.

▶ **Easy To Use**—The automatic punched-card reader makes the navigation computer extremely easy to use, as Collins demonstrated to AVIATION WEEK in its twin Beech during a flight from Cedar Rapids to nearby Iowa City. (Iowa City has its own VOR station but it wasn't used during the demonstration.)

Rolf Wollan, the Collins pilot, selected a card which had been previously coded for use with the Moline and Burlington, Ill., VOR stations. The Collins pilot inserted the card in the reader and pushed a lever which "seated" the card and simultaneously gave the card reader tuning control of the airplane's two VOR receivers.

Wollan then measured, on an aeronautical chart, the airline distance from the Moline VOR station to the Iowa City airport. This distance, about 44 nautical miles, was set in on the waypoint selector. Wollan next determined the magnetic bearing of a line connecting the Moline station with the Iowa City airport (about 280 degrees) which was also set in on the azimuth counter of the waypoint selector.

▶ **Just Like Omni**—Once these two manual settings had been made, the system was ready for operation in exactly

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the same manner as the pilot would fly omni-range signals. The computer had in effect erected a synthetic VOR and DME station at the Iowa City airport.

Once we were airborne, the pilot had the customary choice of omnirange radials to the Iowa City airport. The pilot decided on the most direct route (the radial passing through our existing position) and so he turned the course selector knob on the Collins course indicator until its bar and arrow were aligned.

Had the aircraft been equipped with a conventional omni-bearing selector (OBS) and cross-pointer indicator (instead of the Collins course indicator), the pilot would have turned the bearing selector knob until the vertical needle on the cross-pointer indicator was centered.

▶**On the Beam**—A glance at the distance indicator on the Beechcraft panel showed that we were about 18 nautical miles from Iowa City. The pilot flew the plane to keep the course indicator bar and arrow aligned, just as he would if flying the omnirange. The distance indicator ticked off the miles until suddenly the "to-from" flag on the Collins course indicator dropped from the "to" to the "from" position.

"We should be over the Iowa City airport," Wollan said as he dipped a wing. A look proved that both the pilot, and the computer, were right. We were perhaps ¼ to ½ mile to the right, but that was good considering the inherent limitations of the computer, and the hasty and approximate distance and bearing measurements we had fed into the computer.

▶**Multi-Station Cards**—As presently designed, a single punched-card can be coded to provide a choice of five different VOR station combinations for cross-country flight. The pilot can instantly change from one pair to another by rotating a small knob on the card reader. A small window in the card reader shows which two stations are in use.

The card selected for a cross-country flight must include VOR stations whose geographical locations will provide adequate signal coverage along the flight route. Two tiny signal flags are included in the distance indicator to warn the pilot when signal strength of either VOR station becomes too weak for satisfactory computer operation.

When it becomes necessary to change VOR stations, the pilot rotates the card reader knob. No other manipulations of the computer or associated equipment are needed and there is no more than a moment's interruption in computer service.

▶**Use in ILS Approaches**—At the International Air Transport Assn. meeting last spring in Copenhagen, the pilot's need for a continuous indication of distance to touchdown during ILS approaches came under discussion. The information given by the outer, middle, and boundry markers is too discontinuous, it was felt. The Collins computer can solve this problem providing there is a VOR station within the local area of the ILS runway.

Under these conditions, the computer can solve its trigonometric problem with sufficient accuracy to permit a 10:1 increase in the distance indicator's scale factor. Instead of a 150-nautical mile full-scale indication, a 15-mile scale is used during an ILS approach.

▶**ILS Approach Technique**—When used in an ILS approach, the pilot sets the magnetic bearing of the ILS runway into the Collins course indicator. The distance counter on the waypoint selector is set at zero. (The azimuth angle setting on the waypoint selector may be left in any position because it has no effect when the distance counter is set to zero.)

The punched-card is coded to automatically tune one VOR receiver to the localizer frequency and to change the distance indicator scale factor. From there on it is a conventional ILS approach except that the pilot has a continuous indication of distance to touchdown.

A similar technique is used if the air-

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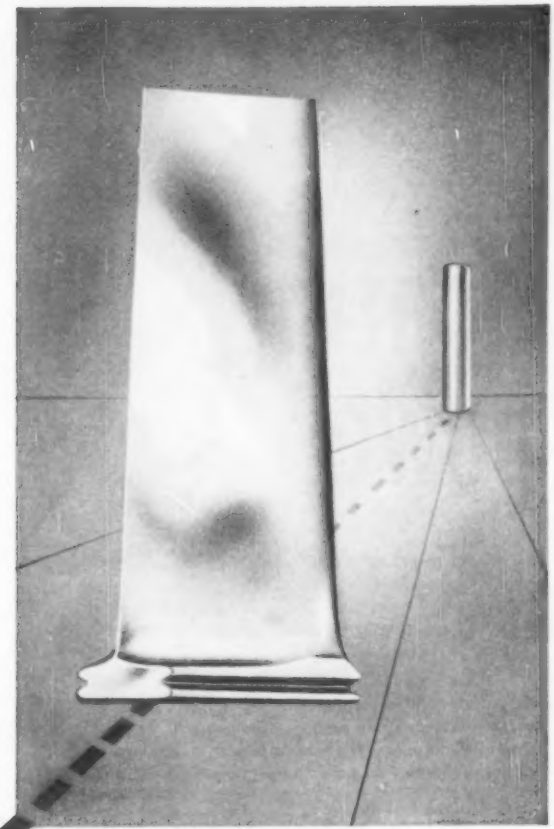

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craft is being flown to an airport equipped with VOR and the "arbitrary course" feature isn't required. The waypoint selector distance is set to zero and the distance indicator then reads distance to the VOR station.

▶**Accuracy**—The Collins computer accuracy when operating as a theta-theta computer is generally almost as good as when operating as a rho-theta computer. Under some conditions of airplane location relative to the VORs, the theta-theta accuracy is slightly better than a rho-theta computer, a preliminary Collins analysis shows. This is based on assumed VOR bearing errors of 2 deg. and a DME error of 0.3 mile plus 2% of the measured distance.

This analysis, which Collins emphasizes is not yet complete, indicates that the computer will give position errors of less than a mile under favorable conditions. When used in ILS approaches, errors are cut to one tenth this value by the change in scale factor.

▶**Operating Limitations**—Under some conditions of airplane location relative to the two VOR stations in use, the triangulation errors of a theta-theta computer become excessive. This happens when the lines of bearing (or reciprocals) to the two stations differ by less than (approximately) 15 degrees.

If this condition arises, the Collins computer automatically drops the flag alarms on the distance indicator and the course indicator (or cross-pointer indicator). With this warning, the pilot can either change to a new pair of VORs or fly by compass heading until he has passed through the critical 15-deg. zone. By careful selection of VORs in advance of flight it is usually possible to avoid flying through such un-useable areas.

▶**Principles of Operation**—The Collins device is an analog-type computer operating on the null-balance principle and using 400 cycle a.c. signal voltages. It consists of two individual, but not independent, elements. One establishes airplane position relative to the two omnirange stations by calculating the distance to one station (arbitrarily called the "master" station). The other element establishes the arbitrary course to a waypoint or destination, and calculates the distance to this point.

Because the distances involved are reasonably short, computation is based on plane-trigonometric equations rather than on the more-difficult-to-mechanize spherical trigonometry.

▶**Position Calculator**—When a pilot, using a basic omnirange receiver, wants to determine his bearing to the station, he rotates the bearing selector knob on his omni-bearing selector until the vertical needle of his cross-pointer indicator is centered. He then reads the station bearing on the OBS dial.

In the Collins navigation computer,

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Transmitters	AY201-1	26V, 400~, 1 ph.	225	1.25	25+j115	11.8	9.5	3.5	15
	AY201-4	26V, 400~, 1 ph.	100	0.45	45+j225	11.8	16.0	6.7	20
Receivers	AY201-2	26V, 400~, 1 ph.	100	0.45	45+j225	11.8	16.0	6.7	45
Control Transformers	AY201-3	From Trans. Autosyn	Dependent Upon Circuit Design				42.0	10.8	15
	AY201-5	From Trans. Autosyn	Dependent Upon Circuit Design				250.0	63.0	15
Resolvers	AY221-3	26V, 400~, 1 ph.	69	0.35	108+j425	11.8	53.0	12.5	20
	AY241-5	1V, 30~, 1 ph.	3.7	—	240+j130	0.34	239.0	180.0	40
Differentials	AY231-3	From Trans. Autosyn	Dependent Upon Circuit Design				14.0	10.8	20

**Also includes High Frequency Resolvers designed for use up to 100KC (AY251-24)

AY-500 (PYGMY) SERIES

Transmitters	AY503-4	26V, 400~, 1 ph.	235	2.2	45+j100	11.8	25.0	10.5	24
Receivers	AY503-2	26V, 400~, 1 ph.	235	2.2	45+j100	11.8	23.0	10.5	90
Control Transformers	AY503-3	From Trans. Autosyn	Dependent Upon Circuit Design				170.0	45.0	24
	AY503-5	From Trans. Autosyn	Dependent Upon Circuit Design				550.0	188.0	30
Resolvers	AY523-3	26V, 400~, 1 ph.	45	0.5	290+j490	11.8	210.0	42.0	30
	AY543-5	26V, 400~, 1 ph.	9	0.1	900+j2200	11.8	560.0	165.0	30
Differentials	AY533-3	From Trans. Autosyn	Dependent Upon Circuit Design				45.0	93.0	30

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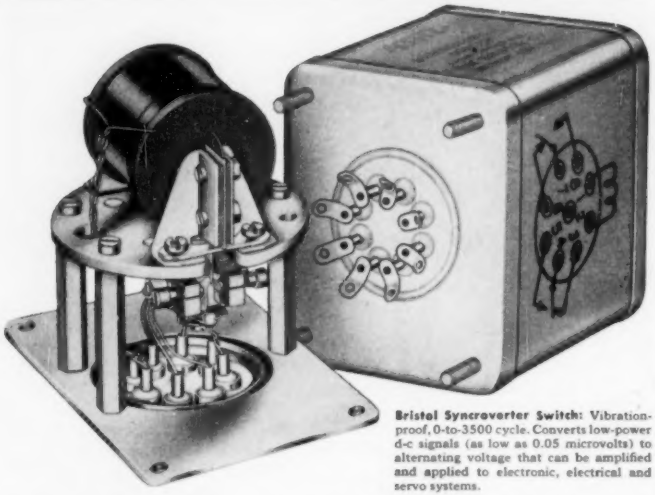

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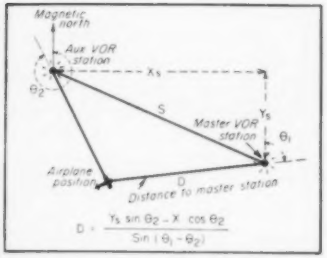


COLLINS COMPUTER uses trigonometry to solve for the airplane's distance to the master station, using the equation shown under the figure.

this task is continuously and automatically performed by two small servo systems, one for each of the two omni stations. These two servos set up station bearing angles θ_1 and θ_2 in the computer. (See diagram above.)

Each of these two bearing angles, as obtained from the receivers, is referred to the magnetic north of its respective station location. Since magnetic variation (difference between true and magnetic north) at each station may be different, correction must be made so that both bearing angles are measured from the same reference. The station selected as the "master" for any particular flight serves as this reference. The correction angle, normally less than 4 deg., is introduced into the bearing of the auxiliary station (θ_2), by the punched-card reader.

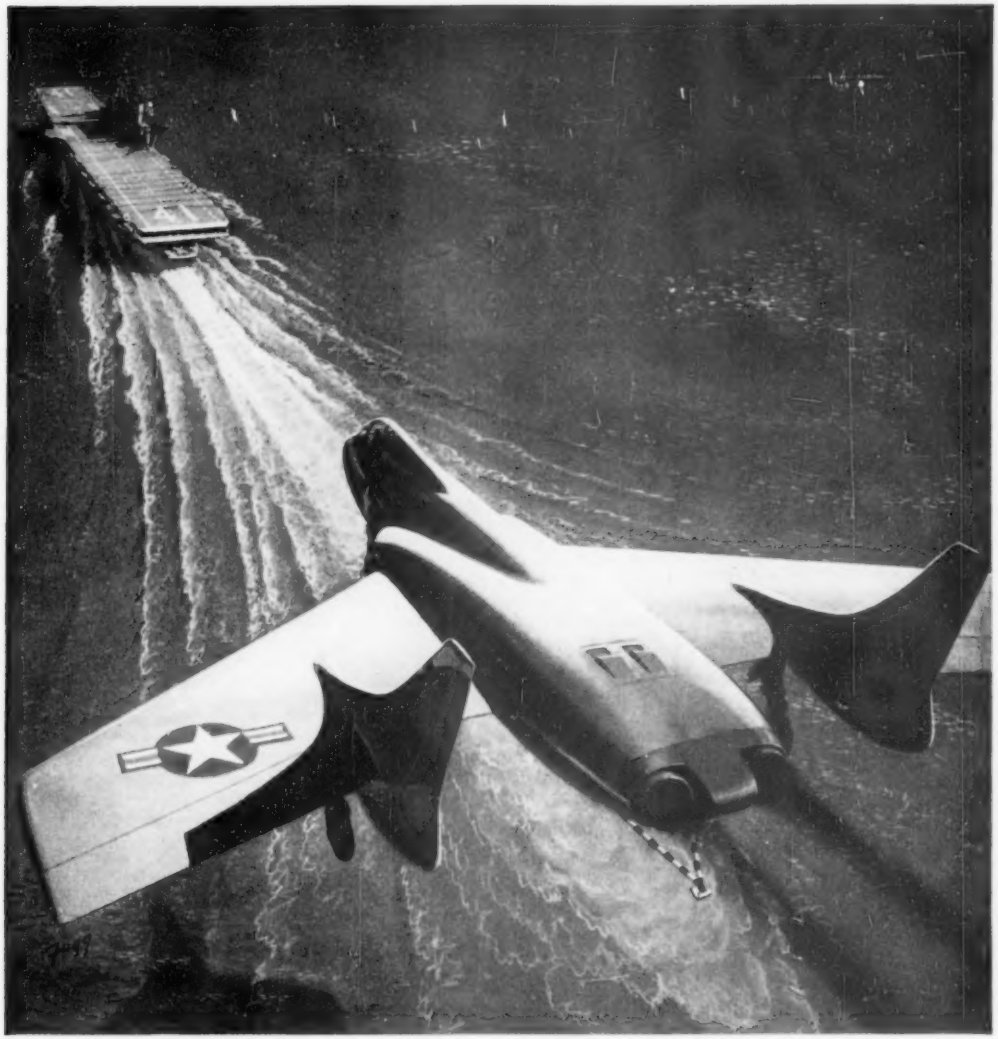
One added bit of information is required before the position calculator can go to work. It needs to know the distance (S) between the two omni stations. The punched card supplies this input in the form of east-west (X_s) and north-south (Y_s) components of this distance. The card reader converts these distances into proportional 400 cycle a.c. voltages.

► **Distance-to-Station Equation** — The equation for the distance to the master VOR station which the computer solves is:

$$D = \frac{Ys \sin \theta_2 - Xs \cos \theta_2}{\sin (\theta_1 - \theta_2)}$$

The angle θ_2 is the auxiliary station bearing angle, corrected for difference in magnetic variation. The rest of the trigonometry is performed with resolvers.

(A resolver is a small synchro-type device used to resolve incoming voltages into their sine and cosine components. The resolver's sine winding will deliver a voltage proportional to the product of the exciting voltage—applied to the rotor winding—and the sine of the angle through which the resolver's shaft has been rotated from its null position. The cosine output winding operates on the basis of the cosine of the angle of shaft rotation. If



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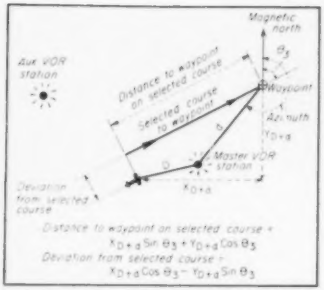
Magnetic north
Aux VOR station
Distance to waypoint on selected course
Selected course to waypoint
Waypoint
Azimuth
Master VOR station
Deviation from selected course
Distance to waypoint on selected course = $X_{D-A}\sin\theta_3 + Y_{D-A}\cos\theta_3$
Deviation from selected course = $X_{D-A}\cos\theta_3 - Y_{D-A}\sin\theta_3$

COMPUTER calculates distance to waypoint and deviation from selected course, using distance to waypoint (previously calculated, figure on p. 48) and coordinates set in by pilot.

the sine-cosine windings are themselves excited, the rotor winding will deliver a voltage of the form $X \sin\theta \pm Y \cos\theta$ where θ is the shaft rotation and X and Y are the voltages applied to the sine and cosine windings respectively.)

The servo systems which establish computer bearing angles θ_1 and θ_2 each drive a sine-cosine resolver. When the cosine and sine windings are excited by card reader voltages proportional to X_a and Y_a, respectively, the voltage output from the resolver is proportional to $Y_a\sin\theta_2 - X_a\cos\theta_2$, the numerator of the distance equation.

A voltage representing the denominator of this equation is obtained by passing a signal generated by a servo-system-operated voltage divider through windings of both the θ_1 and θ_2 resolvers in a series connection. The servo system continuously positions the voltage divider to make the denominator voltage equal to the numerator voltage. As a result the magnitude of the servo-driven divider voltage is proportional to the distance to the master station (D).

▶**When Used With DME**—The purpose of the portion of the computer described so far is to establish the distance to the master station. When DME comes into use, a signal proportional to this distance becomes available from the DME equipment without triangulation. When operated with DME, the computer servo system used to solve the distance-to-station equation is reconnected to set DME distance into the computer.

▶**Arbitrary Course Calculation**—The voltage (derived either from DME or triangulation) proportional to distance to the master station (D) is resolved into an east-west and a north-south component by a sine-cosine resolver driven from the θ_1 servo system. The distance from the master VOR station to the selected waypoint (d), set in by the pilot, is also resolved into E-W and N-S components. This is accomplished by a sine-cosine resolver in the waypoint selector into which the pilot sets the magnetic bearing (azimuth) of the line connecting the waypoint and the master VOR station.

The two E-W and the two N-S distance voltages are added to give total distance voltages, X_{D-d} and Y_{D-d} (diagram at left). Computer then needs only one additional input in order to calculate its answers. This it gets when the pilot selects and sets in the magnetic course he wants to fly to the waypoint. Setting this in the OBS or Collins course indicator rotates the shaft of a sine-cosine resolver through an angle θ_3.

The computer is now ready to solve for distance-to-waypoint using the following equation. Distance to Waypoint = $X_{D-d}\sin\theta_3 + Y_{D-d}\cos\theta_3$. By exciting the θ_3 resolver sine winding with a voltage proportional to X_{D-d} and the cosine winding with a voltage proportional to Y_{D-d}, an output voltage is obtained from one resolver rotor winding which is proportional to the distance to waypoint (on the selected course.) This voltage is converted into a visual mileage indication in the panel-mounted distance indicator by a fourth servo system which positions a voltage divider to buck (null) out the distance voltage, simultaneously positioning the instrument pointer.

▶**Deviation From Course**—A second output voltage is obtained from the θ_3 resolver from another rotor winding displaced 90 deg. from the "distance voltage" rotor winding. This rotor winding voltage corresponds to the course deviation equation:

Course Deviation = $X_{D-d}\cos\theta_3 - Y_{D-d}\sin\theta_3$.

The net voltage (if any) is fed to the deviation bar on the Collins course indicator or to the vertical needle on the cross-pointer indicator.

When the airplane is on the prescribed course, the net voltage will be zero and the steering needle will be centered. If the airplane is left or right of the desired course, the net voltage will have the proper phase to displace the steering needle in the appropriate direction.

▶**Reliability**—By using null-seeking servo systems to mechanize its computations, Collins has made the computer accuracy independent of normal voltage and frequency variations experienced in aircraft 400-cycle power supplies.

The Collins navigation computer is much less complicated than DME airborne equipment, has no "sensitive circuits," and should therefore prove less susceptible to failure. In fact, all of the functions performed by the 12 vacuum tubes in the computer could be accomplished by the more rugged and reliable magnetic amplifiers.

▶**Future Plans**—Collins is currently production-designing its navigation

computer to incorporate improvements suggested by extensive flight tests of the present development model. On the strength of interest shown by possible users, Collins plans to build a limited quantity of production models for off-the-shelf sales.

FILTER CENTER

► **High Altitude Problems**—The high-flying B-36 and RB-36 have shown up curious avionics equipment problems, including one where spurious targets appeared on the radar because of cold-temperature shrinkage of its long waveguide. The shrinkage loosened waveguide fittings, allowing radar energy to leak out, bounce around inside the fuselage, and return to appear on the scope as a target at extremely close range, W. H. Crow of Convair told a recent RTCA meeting in Buffalo.

► **Convair Drops Temperature Limits**—Convair has lowered the low-temperature specs for practically all of its contractor-furnished-equipment used on the B-36 to "well below —65F" because of temperatures the B-36 has encountered at high altitudes, Crow also told the recent RTCA meeting.—PK

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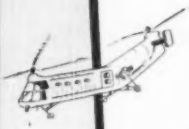

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FINANCIAL

Airline Income in the Third Quarter 1951 and 1952

	Total Operating Revenues		Net Income	
	1952	1951	1952	1951
	(000 Omitted)			
American	$51,197	$45,266	$4,663	$3,680
Braniff	9,265	6,075	284	498
Capital	11,421	10,774	1,001	768
Chicago & Southern	13,974	11,856	959	874
Colonial	2,110	1,686	117	311
Continental	2,671	1,735	130	117
Delta	6,553	6,032	821	387
Eastern	28,607	21,203	1,014	801
National	6,052	5,785	86	222
Northeast	2,658	1,978	415	274
Northwest	16,501	14,609	1,487	1,417
TWA	45,997	38,985	4,271	2,902
United	46,178	36,890	4,480	4,007
Western	4,983	3,315	470	577

Traffic Rise Bolsters Carrier Net

Third-quarter reports of 14 airlines show a 20% gain over 1951: nation's average industrial gain: 5.2%.

A definite improvement in airline earnings is revealed in third-quarter results reported by most of the industry. A group of 14 air carriers shows net earnings of $20.2 million for the current third quarter as compared to $16.8 million for the same period a year ago. This gain of 20% compares with an average improvement in earnings of only 5.2% shown by a total of 727 industrial companies during the same period.

A few carriers believe improved results are due to better cost control, but it may be premature to assume this, for these other factors also played a part:

- The third quarter generally represents a peak seasonal period for many of the operators. When volume of operations is rising the leverage factor tends to create a condition of rapidly expanding earnings which, in turn, sometimes camouflages cost factor elements.
- In a few instances, profits on the sale of equipment contributed importantly to third-quarter earnings.
- Current comparisons are also being made with adjusted 1951 reports due to restatement of tax accruals and other items.

▶ **Traffic Rise Helps**—There is no doubt that sharp increases in traffic underlie the gains in earnings reported. This can be seen from the accompanying table which reveals third-quarter gross revenues and net income. Of the 14 carriers presented only four failed to demonstrate any comparative improvement in third-quarter earnings; and special factors prevail in these cases.

▶ **Closer Look**—A study of some of the individual reports turns up interesting sidelights on third-quarter operations of the carriers.

- **American Airlines** showed an all-time high in gross revenues and earnings for the current quarter, the product of new peaks in passenger traffic during the period. As a result of the excellent showing in the third quarter, the company was able to overcome the lower earnings (in contrast to the like 1951 period) of the first six months of this year. The cumulative net earnings for the first nine months of 1952 aggregated $9,762,759 as compared with $9,460,655 for the same period of 1951. The continuation of the same trend in passenger traffic, revenues and earnings for the remainder of the year can assure American a banner year with new all-time highs.
- **Braniff**, in reporting its third-quarter results, notes that its Latin American division sustained an operating loss "which should be recouped together with a profit when (the) final international mail pay is decided by the CAB. . . ." Until the Board issues its findings in the proceeding, however, no conclusive financial report is possible, nor can any expectation of augmented earnings from this development be anticipated. Braniff also notes that the consolidation with Mid-Continent and

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The Second Annual Trade Show of the Institute of Surplus Dealers will be held January 6 to 8, at the Hotel Statler, New York. Eugene P. Connolly, president of the Institute, said the Show will include goods estimated at $100,000,000 in value.

The Show promises to exceed the records set last year. In addition to aircraft materials, mechanical, electrical and electronic devices, tools, metals, exhibitors will include leading firms in new, used and reconditioned machinery and tools.

One of the most important categories will be aviation surplus, electronic parts and equipment. A careful estimate of such goods indicates an inventory of $10,000,000. This figure represents the offering prices which would be a fraction of the original or replacement cost. Materials in this category represent Army, Navy and Air Force surplus as well as industrial electronic surplus arising from changes in production and new products. At the show last year, sales in this field ran to substantial volume.

The Institute of Surplus Dealers is a national organization of dealers in surplus materials of all descriptions. Last year's show had a record-breaking attendance of 5,000 from all over the world.

Show hours are Tuesday, January 6, 10 A. M. to 10 P. M.; Wednesday, January 7, 10 A. M. to 5 P. M.; Thursday, January 8, 10 A. M. to 10 P. M. Admission is free.

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the introduction of Convair 340s have "plagued" the company with "uncontrollable increasing costs."

• **Delta** affords a good example of a carrier being helped materially through profits on the sale of equipment. For the current quarter, net profit before the "special item" was $377,543, virtually unchanged from the $386,872 shown for the same quarter of a year ago. However a gross profit of $618,976 was realized on the sale of a DC-4 and spare engine. After income tax provision, this left a net capital gain of $442,976.

• **Western,** similarly, despite special operating costs during the third quarter, was helped considerably by a $273,000 capital gain. Non-recurring items of a similar nature were also present in the 1951 earnings.

In almost all cases, 1951 earnings have been restated to reflect tax adjustments arising from mail rate revisions or other causes. It is likely that, for a number of the carriers, similar retroactive adjustments on 1952 results will ultimately appear.

▶ **Basically Firm**—On the whole, the quality of earnings of most of the industry is firm and of considerable substance, reflecting basic profitability. This is particularly true of those carriers now on a permanent mail rate of either 45 cents or 53 cents a ton-mile.

The steadying effect of a permanent mail rate is encouraging. There are enough uncertainties in the nature of air transportation without having reported results subject to subsequent qualifications.

A continuation of this course in the character of airline earnings will go far in developing a higher degree of investor confidence in the industry. But the important factor, of course, in developing and maintaining investment confidence for the airline group, remains in the ability of the individual companies to generate continuing earning power, or at least have the hope of doing so in the future.

—Selig Altschul

Solar Extra Dividend

Solar Aircraft Co. has declared a regular quarterly dividend of 20 cents a share and an extra dividend of 5 cents a share, both payable Jan. 15 to stockholders of record Dec. 31. Backlog amounts to more than $92 million.

TWA Sinking Fund

Trans World Airlines has deposited $2,757,000 to complete all the company's sinking fund and interest payments for 1952 to Equitable Life Assurance Society on loans negotiated in 1945-46. This reduced the original loan of $40 million to $26,630,000.

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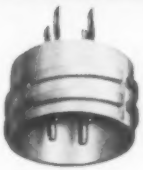

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Refer to KH-1 Section in K Bulletin.

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See GS-3 section in AN-8 Bulletin for details.

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Hydraulic Experts Study Pumps, Fluids

- **Airlines tell conference wafer kits reduce noise.**
- **Reports presented on non-flammable fluids.**

By George L. Christian

Detroit—A hundred aircraft hydraulic specialists from all over the world attended the recent Vickers, Inc., Transport Hydraulic Aircraft Conference here. They represented 14 American and seven foreign airlines, U. S. and foreign airframe manufacturers, hydraulic fluid, ball bearing and tubing companies, and the armed services.

During the two-day session, the experts talked about hydraulic pumps (fixed-variable-displacement, and electric-motor-driven), hydraulic motors, valves and accumulators, hydraulic fluids, tube fittings, tubing and hose, and O rings.

A feature of the meeting was the comprehensive discussion of the de Havilland Comet's four main and two auxiliary hydraulic systems by British Overseas Airways Corp.'s Sydney Oldfield, the firm's chief technical officer, chief development engineer's branch, London. This paper was carried in detail in AVIATION WEEK Dec. 1, p. 56.

Pumps, Fixed Displacement

Damping the sharp pressure rises of pulsation and muting the resultant noise are being successfully accomplished by the Vickers-developed wafer kit installation on the company's pumps, the meeting heard.

Here is a summary of the views expressed about the effectiveness of wafer kits and savings to be derived from their use:

- **Noise accumulators** used on DC-6s and -6Bs will be eliminated on the DC-7, whose pumps will incorporate wafer kits, the Douglas spokesman said. He added that the kit eliminated 85% of hydraulic system noise.
- **Flight tests will be conducted** on 1049s, Lockheed said, to see if wafer kits could eliminate pulsation filters, standard equipment on Constellation airplanes.
- **Braniff discarded noise filters,** inasmuch as wafer kits reduced noise level 50%. There was also a considerable saving in maintenance, Braniff found.
- **Increased pump life** was cited by Northwest—pump overhaul period was raised from 1,500 to 3,000 hours. A functional check is still made at 1,500 hours.
- **Pan American** said it ran its pumps 2,400 hours on Convair 240s.
- **Operational pump check** at first engine change and removal at second engine change is the procedure at American.
- **Eastern** said the kits were giving good results.

Various airlines cited low overhaul cost of Vickers pumps. Their figures:

	1951	1952
• AA (DC-4 & 240)	$.0125/hr.	$.008 /hr. (6 mo.)
• BNF (DC-4)	———	$.037 /hr. (3 mo.)
• CAP (DC-4)	$.011 /hr.	$.013 /hr. (7 mo.)
• UAL (DC-4 & -6)	———	$.017 /hr.
• TCA (DC-4M)	$.0347/hr.	$.0153/hr. (6 mo.)

Trans-Canada described the failure picture for Vickers pumps in the period June 1951 to May 1952: time accumulated—134,816 pump hours; one malfunction (reason, worn parts); two removed as a precaution due to dry system; two removed, tested OK and reused; one removed due to damaged fitting caused by ground handling.

Some Convair operators expressed concern about the hydraulic system's inadequate fluid flow when the plane was taxiing with engine turning over slowly. United, for instance, had poor braking when the ground cooling fan was in operation, but licked this problem by installing a priority valve which cuts fluid flow to the fan when system pressure drops below 1,900 psi., restores the flow when the pressure reaches 2,000 psi.

KLM had an interesting approach to the problem of pump rear oil seals scoring the rotating group shaft. The airline made up a plastic shaft and a transparent housing. This was given to mechanics and their technique of installing the seal studied. Result: showed that 60% of the mechanic did not know how to install the seal.

Pumps, Variable Displacement

Aetna thrust bearings in Vickers variable-displacement pumps came in for favorable comment by the airlines.

Chicago & Southern is getting two runs out of the Aetna bearing instead of one run.

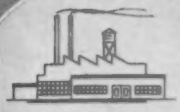
Trans-Canada and TWA replace the bearings "on condition." Trans World's spokesman said that his experience with the Aetna bearing was that if it would last one run, it was good for two more. Majority of failures occurred during the first run.

Aetna's representative pointed out:

- **Metal fatigue,** not wear, is the usual cause of failure of an antifriction bearing.
- **Even load distribution** over all the balls is very important.
- **Bearing race spalling** is cause for immediate rejection.
- **Bearing must be installed square** on its shaft.
- **Heavy centrifugal loads** created by rapidly rotating balls is a problem.

▶ **Chips in the System**—Airlines agree the most common source of hydraulic fluid contamination is pump failure. So the question was raised: Why are

Let's all pull together



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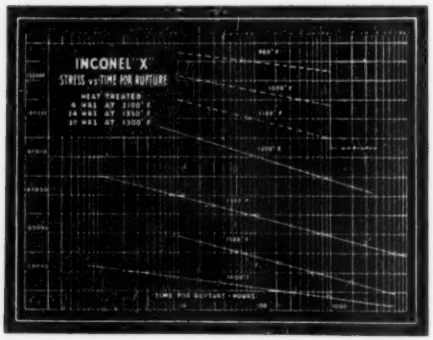

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pumps protected from the system by filters but the system is normally not protected from the pumps?

Lockheed said that it had had a bad time with chips in the system—although 85% would go down the case drain, 15% were pumped into the pressure line. Lockheed had considered putting an .008 chip strainer in the system, but since gear retraction time on Connies is critical, pressure drop such a unit would create was considered undesirable. It was also felt micronic filters would impose an unacceptable weight and size penalty.

R. Ascencio, Air France's representative, noted that the Vickers Viscount and Sncase Languedoc aircraft have filters on the hydraulic pump outlet lines. He stressed the fact that flushing a hydraulic system was an expensive and time-consuming job which grounds an aircraft for a relatively long period of time. Therefore, filters in the pressure line are desirable, if they can be installed without undue penalties to hydraulic system performance.

Chance Vought has 5-micron filters in one of its aircraft. These are backed up by an 80-mesh filter to catch debris of the micron filters if and when they blow up. CV added that its experience had been that when a pump fails, filters clog and by-pass valves open, flooding the system with chips. So, even with filters in the pressure line, flushing usually is still required.

TWA said that it flushed hydraulic systems so seldom that this was not a matter of too great concern.

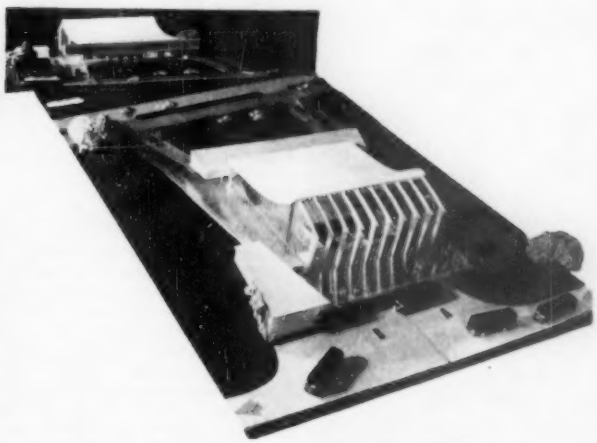
Valves & Accumulators

Airlines reported on results of using the -A version of the Vickers AA-34500 series unloading valve instead of the basic design:

- **TWA:** Substantial improvement . . . valve is completely satisfactory.
- **EAL:** In process of changing over, no opinion so far.
- **AA:** Valve is an improvement, but it still fails and is noisy.
- **UAL:** Have had some trouble with valve's maximum service life on Convair 340; changing O ring to Teflon (when used with Skydrol), but noise valve makes with Teflon O ring indicates that this may not be the answer.

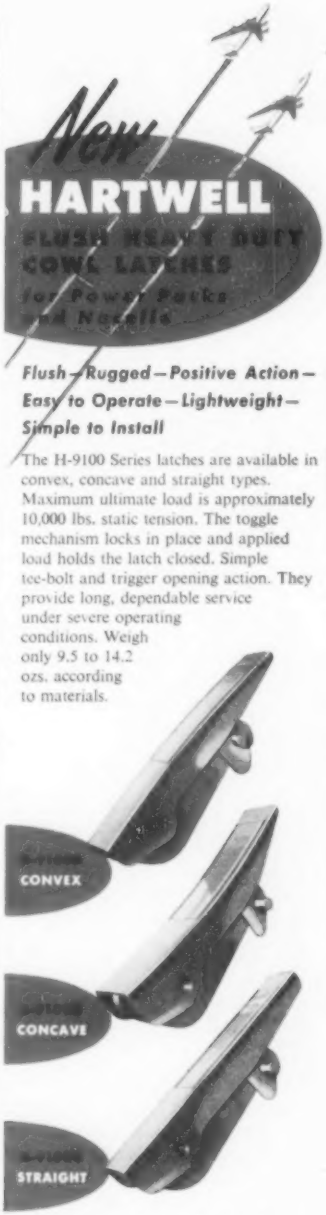
General consensus was that the valve was more reliable and did reduce noise.

In the discussions about accumulators, Northwest expressed concern about the AV6287 high-pressure air valve used on new Bendix accumulators. The 2-in. hex assembly of the valve has safety-wire holes, but the accumulator does not. The carrier contended the mechanic had no warning that he was running out of threads when unscrewing the valve so that it was possible for an unsuspecting workman to



NEW KEY TO AIRPORT PROBLEMS

A Swiss architect has come up with the Air Key Terminal—designed to take some of the walking out of flying. The terminal scheme seeks to "avoid everything which might constitute a hindrance to the fluidity of travel," its designer, K. K. Perslee states. Planes are serviced and fueled a good distance away from the terminal in this design, reducing hazard to passengers and eliminating aircraft congestion which is common in today's airports. Passengers will get from the terminal to the planes in shuttle buses with loading ramps adjustable to the height of various aircraft. Information is available from Air Key Terminal Planning Office, 17 Rue de Candolle, Geneva, Switzerland.



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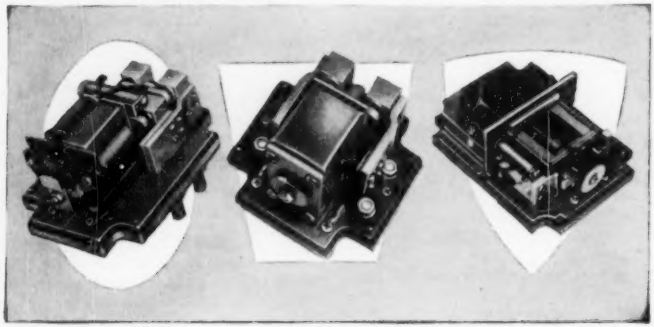

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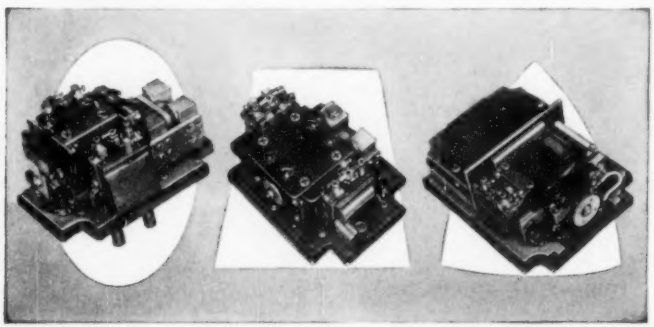

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have a valve blow out on him. Old valves hiss first, giving warning that only a few threads are left. At NWA new valves are being replaced with the older, hissing type.

Hydraulic Fluids

The competition between Monsanto's Skydrol and Hollingshead's H-2, the "Big Two" of non-flammable hydraulic fluids, continues.

▶ **UAL Skydrol Tests**–United is still testing both fluids. Skydrol has been tested on a C-54, and is going into UAL's DC-6Bs and Convair 340s. The carrier reports:

• **Skydrol** has posed mostly nuisance problems, such as trouble with pump shaft seals and with windshield wipers. Maintenance troubles have been limited to difficulties with tubing clamps and door seals.

• No appreciable increase in component life has been noted to date, despite Skydrol's increased lubricity.

▶ **UAL H-2 Tests**–UAL tested H-2 in a domestic C-54 cargo plane for 1,800 hr. The carrier was compelled to switch back to conventional fluid (3580) when the plane was changed from cargo to tourist operation.

Several hydraulic components, such as relief valves and brake assemblies, were removed at engine change (1,000 hr.) and no detrimental results of H-2 were found. (The 1,000-hr. mark is not UAL's normal engine change period, but was used on this plane to fit it into overhaul pattern.)

At 1,800 hr., when the system was reconverted to normal fluid, no hydraulic units had been pulled for cause. After reconversion, one trouble was encountered–retract strut seals started to swell, apparently because of multiplicity of fluid changes;–the switch from 3580 to H-2 and back again was done with no change in seals.

▶ **Navy & H-2**–BuAer's representative said that H-2 is going into all of its new production aircraft. Existing planes are being converted when convenient.

Navy cited these advantages of H-2:

• **Mixing with petroleum-base** fluids (in proportion of approximately 90% H-2, 10% petroleum-base fluid) is possible. So it is a simple matter to drain out old fluid and convert to H-2.

• **Seals used with petroleum-base** fluids may be used with H-2. This saves a large number of manhours when converting existing aircraft to H-2.

• **Price advantage** of roughly $8 a gallon over Skydrol makes H-2 attractive. Navy buys about half a million gallons of fluid a year. Saving could be about $4 million.

▶ **Navy Problems**–Problems Navy has been experiencing with H-2:

• **Corrosion** when steel comes in direct contact with aluminum in stagnant

areas, where there is no fluid flow. Navy cited an instance when, in a short period of time, landing gear down locks on several carrier fighters corroded and became inoperative, apparently because of H-2. Belly landings resulted. Fix was to chromeplate the steel components of the down lock. Anodyzing the aluminum would also solve the problem. Hollingshead spokesmen said that they are actively engaged in improving H-2 to eliminate this corrosion problem entirely.

• **Leather back-up rings** gave trouble. Substitution of Teflon rings licked this problem.

• **Excessive surges**—up to 6,500 psi. on a 3,000 psi. system—have been experienced.

▶ **Hollingshead Views**—Chance Vought said that it was having trouble making close tolerance valves work with H-2 in 3,000-psi. power control systems. Otherwise, the fluid gave good results. But the CV representative said that the corrosion problem would be hard to live with indefinitely if something were not done about it.

Hollingshead said that, as far as it knew, the corrosion, where dissimilar metals were in contact, was only on the surface, was easily cleaned up and had not caused any malfunctioning of hydraulic system components.

The company's spokesman said that Transocean Air Lines, which tested H-2 in a DC-4, had a pump-to-fire-wall high-pressure hose break, but no fire resulted.

When the fluid was removed (it was apparently causing autopilot trouble) all seals, accumulator bladders and hydraulic components were found to be in good shape. Hollingshead added that brake leakage had actually been reduced and internal leakage slowed to the point where the hydraulic system cycling time changed from three to five minutes. H-2 will be put back in all the carrier's DC-4s as soon as new autopilots replace the current models, according to Hollingshead.

CAA is using H-2 in three DC-3s with no reported trouble, the company said. H-2 is also being used successfully in several executive DC-3s.

▶ **Skydrol Data**—Skydrol, whose primary use has been in DC-6 cabin supercharger drive systems, is now going into the main hydraulic systems of DC-6Bs and Convair 340s coming off the production line.

Capital Air Lines said that it had trouble with Skydrol in its three Super DC-3s which it sold to and maintains for U. S. Steel. The fluid becomes contaminated with pieces of O ring, Capital says. Monsanto, which operates its own fleet of three DC-3s, has no such trouble.

Douglas Aircraft Co. said that Allube is the only lubricant developed for lubricating seals prior to their installa-

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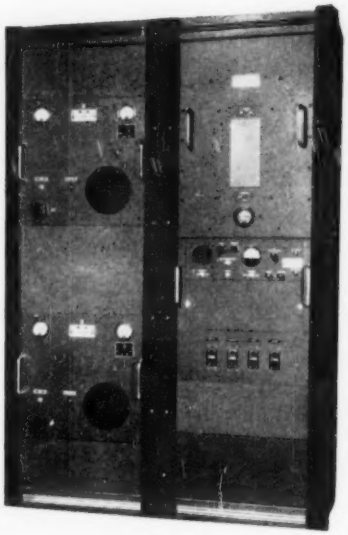

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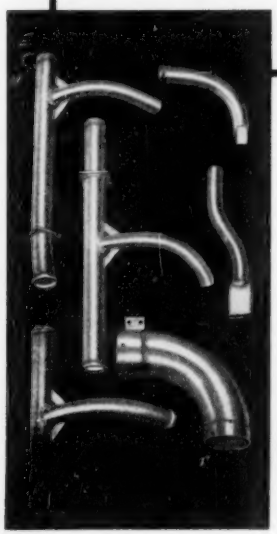

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tion in a component to be used in a Skydrol system. Users say Allube gives excellent results.

Skydrol O rings are made of butyl rubber. Goshen Rubber said butyl is more difficult to vulcanize than other types of rubber. Sometimes the rings are under-cured, which gives them a tendency to swell. Butyl rings have less resistance to tearing and chipping than AN rings.

A suggestion that some O ring swelling might be due to non-uniformity of Skydrol was denied by the manufacturer who maintained that rigid inspection and testing prevented this.

Douglas said that Skydrol seals were not as resistant as AN seals. But it noted that most O ring chips start when the ring is installed on the piston, and chamfering the piston edges slightly helps avoid this chipping.

American Airlines said Skydrol gave good results in its DC-6 superchargers. But two problems were experienced—paint removal and short seal life. The airline added that H-2 is attractive because of lower conversion cost and its price. AA is still evaluating Skydrol and H-2, but has not yet made up its mind.

► **New Water-Base Fluid**—Carbon & Carbide Chemicals Co. has developed a new water-base fluid, Ucon Hydrolube AC, which may solve some of the problems previously encountered with waterbase compounds. The fluid has passed laboratory testing and is at the pump test stage. It is 35% water and contains inhibitors and additives.

Some characteristics of Ucon Hydrolube AC, as listed by Carbide.

- **Viscosity is equal to H-2.**
- **No separation occurs** between —65F and 250F.
- **Corrosion protection is excellent.**
- **Rubber swell characteristics** are good (less than 5%) but leather back-up rings will swell, especially at high temperatures.
- **Pump life is equal** to that obtained with H-2 fluid under conditions of 160F and 3,000 psi.

BuAer is buying 2,000 gal. for aircraft testing.

► **Non-Flammable Developments**—F. Straus, Air Materiel Command, outlined three non-flammable fluid developments:

- **Organo-phosphate fluid.** Made by Monsanto and called S-40, the fluid is self-extinguishing to a high degree and is good for —65F to 250F.
- **Silcone fluorocarbon** diester-type fluid. Made by Dow Corning, and labeled XF-408, the fluid is less flammable than petroleum-base types but is not completely compatible with petroleum fluids. Temperature range is —65F to 300F.
- **Bromonated benzene fluid.** Developed by Penn State, the fluid is completely non-flammable. But its compatibility characteristics are not known,

and its density is relatively high.

▶ **High Temperature Problems**—USAF representatives mentioned these problems encountered in high temperature fluid development:

- **O rings** take a permanent set at 300F.
- **Teflon,** the material which gives excellent results in hydraulic system applications, such as back-up rings, acts up at high temperatures. First it starts to cold flow; over 400F, it has a tendency to chip.
- **Flex hose** gets brittle, takes a permanent set and end fittings leak at elevated temperatures.

Many problems have to be solved before practical high-temperature systems become practical.

Fittings, Tubing, Hose

Ermeto hydraulic tube fittings generally came in for praise. TWA said its service experience with the product has been excellent—no loosening and no leakage. Only trouble was teaching personnel how to handle it.

UAL is using Ermeto on the main hydraulic system of its 340s and the low-pressure refrigeration system of its Boeing 377s. United likes Ermeto but agrees that training personnel is a problem. UAL says Ermeto is good for 1,700-psi. systems.

Pan Am complained that the fittings leaked on high (3,000-psi.) systems and were difficult to install because an Ermeto fitting requires that a length of tubing end be extended into the fitting. This often necessitates loosening other lines, removing hydraulic components or adding elbows—all time-consuming factors.

▶ **Tubing**—Lockheed pressure-checks every hydraulic tube assembly for leaks. It uses only seamless stainless steel tubing. In critical areas such as nacelles, LAC uses stainless steel, 24 ST elsewhere.

TWA traced faulty welded tubing to specific manufacturers and "crossed them off our list."

Titanium is being used in hydraulic systems. Boeing has a Navy contract to experiment with titanium made to AN standards.

▶ **Hose**—Flexible hose is giving a good account of itself, according to the airlines.

PAA has had no failures on its pump-to-firewall installation on DC-4s or DC-6s.

UAL uses the pump-to-firewall hose for four engine runs on its DC-4s. On its DC-6s the hose is limited to one engine change (1,500 hr.), but still gives more trouble than on DC-4s.

American runs its hose for three engine changes, has little trouble.

EAL changes hose every engine run, feels that pulsations, not pressure tend

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to break down the hose.

Eastern and TWA both use flexible hose to effect emergency repairs to hydraulic lines. Method is to block off length of defective line, bend away both ends and link good ends with flex hose, even if several lengths have to be joined to stretch the necessary distance.

O Rings

Teflon has emerged as an ideal material for back-up rings, the conference heard. It increases O ring life, decreases nibbling and has a tendency to smooth cylinder bore.

Douglas said that quality control improvement in the last six months has been reflected in great improvement in rings going into its aircraft.

Teflon is used universally on pressure and static seals.

TWA maintains no age control or special packaging of its rings. BOAC recommends a maximum storage time of six months. It thinks that is why it has little O ring trouble.

PAA maintains no time limit but thinks one should be established. It wants rings packaged in 25-unit lots with date and part number marked. And it thinks the ring manufacturer should establish storage time limit.

American packages rings in groups, according to the unit to be overhauled.

Navy says individual packaging costs no more than handling O rings in bulk, because of reduction in waste. Initially, individual packaging cost 20% more, but now that the system is in use, price increase has skidded to only 2%. EAL suggested that eliminating one delay caused by faulty O rings would pay for a whole year's packaging.

Goshen Rubber agreed to package rings any way the airlines want them. It estimated cost increase at 10-20%. Goshen's advice: O rings should be kept away from heat, water, and out of direct sunlight.

Skid Devices

Northwest's early service test of Hytrol anti-skid units on one Boeing Stratocruiser indicated an increased brake life of 38% as compared to the nine other planes in its fleet.

But now that the entire fleet of Boeings has been Hytrol-equipped, the test results have not been borne out. Reason is that there is a tendency for the crews to abuse the device by riding the brakes, according to NWA.

From a maintenance point of view, the airline is very pleased with Hytrol—it requires negligible attention. And Northwest anticipates an increase in tire and brake life. Since Hytrol was installed, the carrier has experienced no blowouts, and tire flat-spotting has been held to a minimum. These advantages are particularly desirable on overseas flights where spares may not be available.

American made a study of both Hytrol and Westinghouse's Decelostat, and concluded it would take five years to amortize initial installation costs in terms of tire wear savings, without considering the weight penalty. But anti-skid devices are attractive from the safety angle, according to AA, so it is considering the use of them for DC-7s and 340s.

Douglas has tested Hytrol and will soon publish a report on its findings. The manufacturer is making provisions for Hytrol installation on DC-7s as optional equipment.

TWA is testing one set each of Hytrol and Decelosat units on two 049 Connies; the planes are not equipped with reversible props.

AA feels that skid warning lights in the cockpit might be better than anti-skid units. System is lighter, simpler and cheaper than anti-skid devices, AA says.

Boeing said it tried skid warning lights and found that pilots could not react fast enough, so discontinued using them.

Chairman of the conference was American Airlines' W. E. Spearman.

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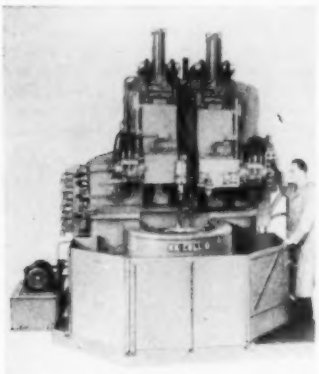

Vertical Bores

A vertical precision boring machine produced by Ex-Cell-O is being used for multiple finishing operations on large wheels for jet aircraft engine compressors. The machine is massive enough for semi-finishing work as well.

In finishing the jet parts, it does precision boring, counterboring, chamfering, feed-facing and rabbeting. Operations can be performed in a choice of automatic cycles which include automatic changes in work spindle speeds.

Versatility is the dominant feature of the unit, its maker says. It can be used for a wide range of work other than machining jet assemblies. Large parts can be loaded on the 36-in.-diameter table which is supported on a vertical spindle. This spindle is mounted in 24-in. taper roller bearings and driven through a precision worm at speeds of 500 rpm., high enough to machine aluminum efficiently. Automatic functions of the equipment include all slide movements, work speed control, lubrication and coolant control.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32.

Broached Bushing

A new type of bushing with a series of minute cutting edges on the outside to cut its own hole exactly to size is a completely new departure in bushing design, according to its manufacturer. This ability of the new so-called "bushing with the broach" to cut its way into position is a distinct improvement, the maker says, over the ordinary type, which has to be placed in holes drilled and reamed to very close tolerances. It is claimed that the broached bushing is not as expensive as the conventional type and that it does not require as

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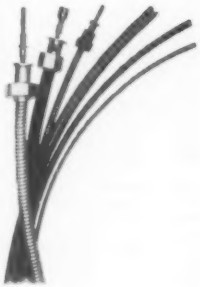
The 256-page S.S.White Flexible Shaft Handbook has full details on flexible shafts. Copy sent free if you write for it on your business letterhead.



✓S.S.White Adapters

Used to connect flexible shafts in close quarters and where space conditions prevent a direct connection without bending the shaft to the point of possible damage. *Drawings and specifications on request.*

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Designed to convert rotary motion into linear movement, S.S.White actuators are used primarily on aircraft trim tabs, but can be used on any other device requiring linear movement. They operate on a "screw-jack" principle and provide smooth, positive action. Can be used with flexible shaft or with direct motor drive. *Write for literature.*

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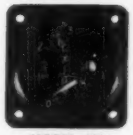
MODEL 17B

MODEL 17B, 2¾" case to AND 10401
—50 to +300°C Cylinder Temp.
(AN 5536-1A or T1A)
—50 to +300°C Bearing Temp. . . .
0 to +1000°C Exhaust Temp.



MODEL 49B

MODEL 49B, 1⅞" case to AND 10403
—50 to +300°C Cylinder Temp. . . .
0 to +1000°C Exhaust Temp.

MODEL 76B

MODEL 76B dual, 2¾" case to AND 10401
—50 to +300°C Cylinder Temp.
(AN 5536-2A or T2A)
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0 to +1000°C Exhaust Temp.

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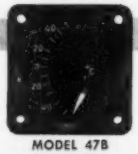
Accurate ratiometers, these **LEWIS** indicators are remarkably free of voltage error, have nearly linear scales (not crowded at the ends) and are magnetically shielded. A few typical ranges are given below. Not shown is Model 46B, 2¾" single.



MODEL 47B

MODEL 47B, 1⅞" case to AND 10403
—70 to +150°C AN 5790-6 or AN 5790T6
0 to +125°C Oil Temp. . . .
—50 to +50°C Air Temp.

MODEL 77B

MODEL 77B dual, 2¾" case to AND 10403
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close tolerance machining.

According to the manufacturer, the broached unit works satisfactorily with a maximum tolerance of .002 in. Normal hole tolerance of the conventional bushing is 0 to .0005 in.

With the broached bushing greater variations in the size of the locating hole are allowable, it is claimed, and once installed the unit is firmly locked in position. The manufacturer says a substantial market for the new bushing is already indicated.

Aeroquip Corp., Jackson, Mich.

Plane Tank Cap

A new all-steel fuel filler cap for pressurized tanks in military craft includes safety features to prevent it from "popping-out" under pressure. It has passed all test specifications of MIL-C-7244, its maker says. The cap is sealed positively and quickly by two revolutions of an engaging screw. Adaptor on the cap can be shaped to conform with various tank contours. The assembly weighs a little over one pound.

Stamping division, Eton Mfg. Co., 18001 James Couzens Highway, Detroit 35, Mich.

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Packing rings, (V types molded from Teflon) are available in two designs—one for low pressure, the other for applications up to 5,000 psi. in valves, pumps, fittings and similar items. Flexrock Co., Packing division, 3622 Cuthbert St., Philadelphia 4.

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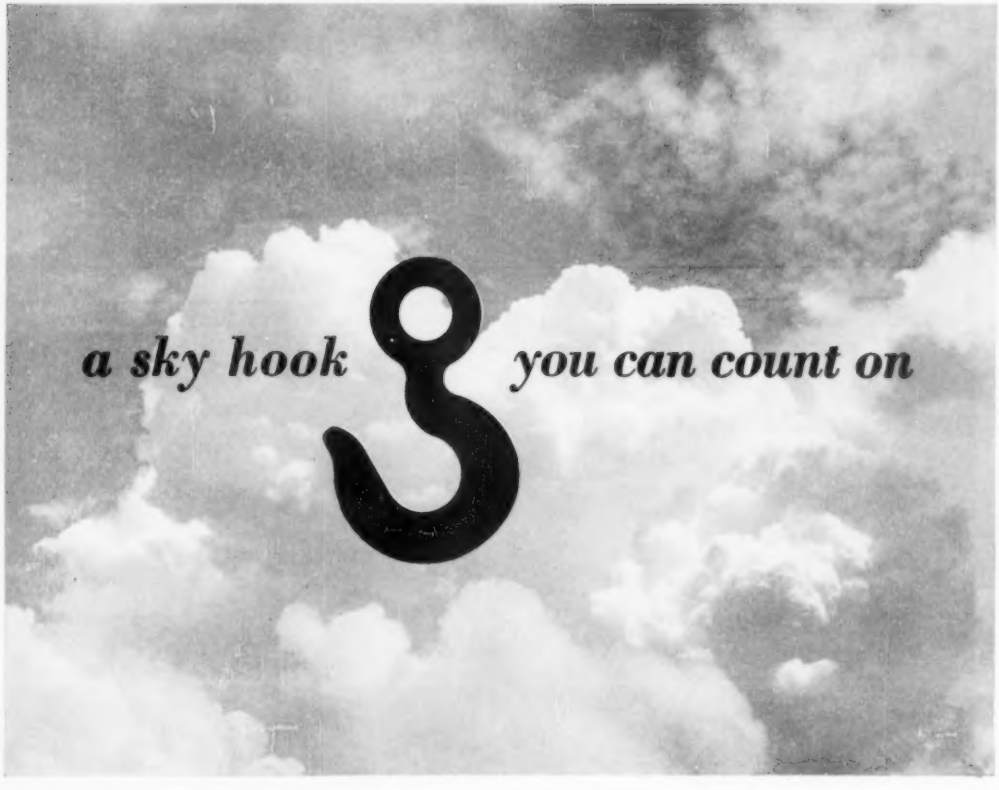

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PROSPERITY in the USA: Who Has It?

How prosperous *are* the people of the United States?

The previous editorial in this series answered this question for the average American. His prosperity has increased only slightly in recent years.

But the average tells only a part, and in many ways not the most important part of the story. Which individuals and groups have prospered more, which less? (The average, the result of a statistical calculation rather than a creation of flesh and blood, tells nothing about that.)

The purpose of this message is solely to get at the facts on this question of how prosperity is distributed. This is not easy. In spite of the crucial importance of the subject, the available information is limited. Even so it is possible to provide a rough answer to the question, "Who has the prosperity?"

We Have Had a Revolution

The distribution of income in the United States has changed so greatly in the past twenty years that Arthur F. Burns, Research Director of the National Bureau of Economic Research, world renowned for its impartiality and technical competence, calls it "one of the great social revolutions of history." A part of this revolution is portrayed by the following table which shows that individual incomes are both much larger and much more evenly distributed than they were twenty years ago. Clearly, a large new middle-class has been created.

DISTRIBUTION OF REAL INCOME

Dollars of Income*	Per Cent of Families in Each Income Group	
	1929	*1951*
Under 1,000	17%	13%
1,000 – 2,000	24	15
2,000 – 3,000	24	18
3,000 – 4,000	14	18
4,000 – 5,000	6	15
5,000 – 7,500	9	14
7,500 and over	6	7
	100%	100%

*Adjusted for price changes to give the dollar its 1951 purchasing power.

Some light on why this income revolution has taken place can be found by tracing incomes to their source. Since 1929, for instance, employees have clearly made the biggest gains in total income. This can be seen in the next table. People who own their own businesses have done second best. Farmers, who are often thought to be doing handsomely indeed, have been outstripped in the income race by employees and businessmen. People whose incomes depend upon pensions, insurance policies, and other relatively fixed returns such as rent, interest and dividends have lagged far behind.

HOW REAL INCOME HAS CHANGED*

Types of Income	Percentage Change 1929 to 1951
Wages & salaries of employees.	+123%
Income of professional men & unincorporated business	+108
Farm operators' income	+56
Rental income	+1
Dividends	+2
Interest	−35

*In this and the previous table account is taken of changes in the cost of living. But adjustment for the changing tax load was not possible, as it is in the computations which follow.

The Biggest Gains

Employees have made the biggest gains in income, but the term "employees" covers a wide assortment of people—from the presidents of the biggest corporations to factory sweepers. How have different groups of employees prospered? Some indication is provided by results of a survey of salaries in 41 corporations made by Arch Patton of McKinsey and Company and recently summarized in the *Harvard Business Review*. This survey showed that between 1939 and 1950, after adjustment both for higher living costs and for higher taxes, factory and office employees made modest gains in income while management personnel suffered losses ranging from 40% to 60%.

While factory and office workers generally have made greater income gains than others, their gains have varied greatly from industry to industry. During the past five years, for example, steel workers' take-home pay (adjusted for both taxes and price changes) has increased by 22%, that of textile workers 9%, employees of general merchandise stores 4%, and that of laundry workers not at all.

What About Organization?

How have organized workers fared compared to unorganized workers? There is no round-up of facts that makes possible a direct comparison between the two. Such evidence as there is shows it is indeed an open question whether union members have done any better than others. Steel workers, for instance, who are strongly unionized are among the highly paid manufacturing workers. Farm workers are generally not unionized, and they work in one of the most competitive industries in America.

But farm workers have made income gains which far surpass those of steel workers. Real wages of farm workers increased 2½ times more than those in the steel industry between 1939 and 1952. This fact may prove nothing more than that, in a period of inflation and manpower shortage, the less skilled workers whose incomes are ordinarily low make the biggest percentage gain in income. Further support for this conclusion is found in the construction industry where real wages of unskilled labor increased 37% between 1939 and 1952, while those of skilled labor increased only 4%.

Why Most Incomes Are Higher

Prosperity, who has it? We may conclude that workers have been getting much more of it lately than managers or property owners, that unskilled wage and salary earners have made the largest gains, and that income generally is much more evenly distributed.

Where has the money come from to raise low bracket incomes? It has come partly from an increase in the total national income, but partly also from cutting down the share received by people in the highest income brackets. While the top 5% received 33.5% of the income after taxes in 1929, their share of income has now been cut about in half. For every $11 of increase in income to the lower 95% of income receivers, about $7 has come from increased production, and about $4 by taking that amount from the top 5%.

Top bracket incomes have now been cut so deeply that the possibilities of increasing the income of the rest of the people by "soaking the rich" have largely disappeared. Indeed, if all of the income after taxes of everyone earning over $25,000 in 1951 was taken away and redistributed among the remaining Americans, each person would receive only about $65.

The significance of this revolution in income distribution is clear. It is that there is only one way by which the great mass of us Americans can continue to increase our individual prosperity. This is by earning the increase through more and more efficient production. In plotting the economic course of the U.S.A. this fact is of decisive consequence.

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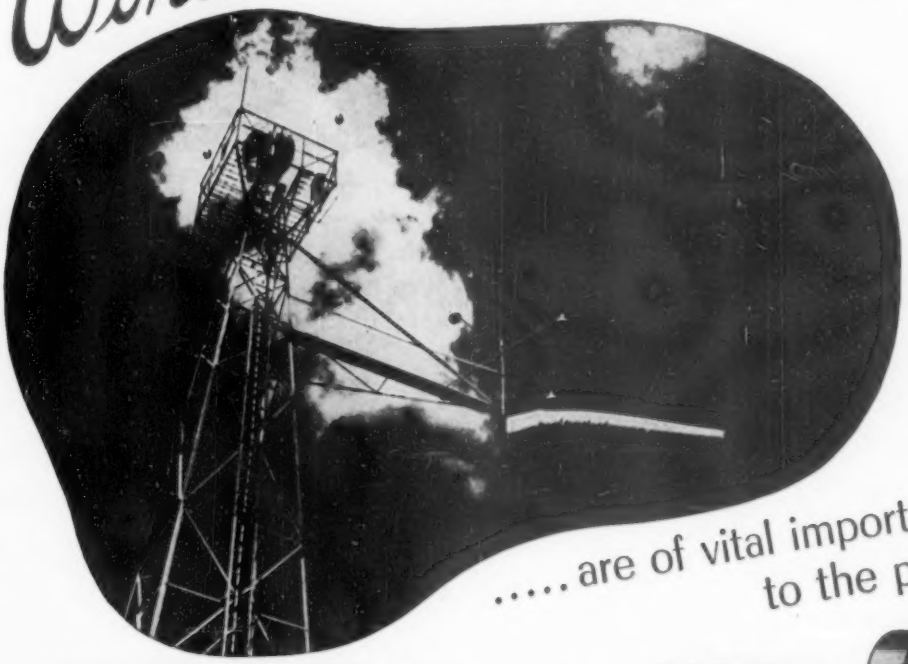
Wind and clouds . . .



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Ceilometer Projector

Ceilometer

Type DCE-16 Ceiling Projector

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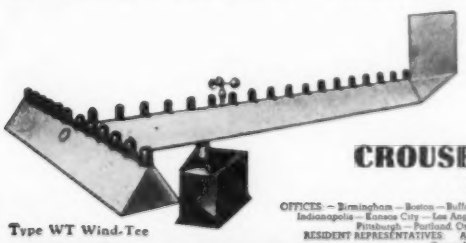

Type WT Wind-Tee

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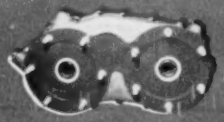
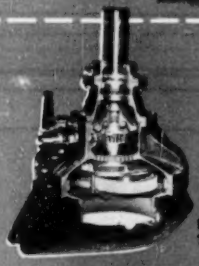
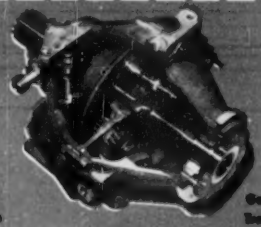


Multiple Takeoffs for Engine Accessories

SPECIAL GEAR DRIVES



Helicopter Transmission



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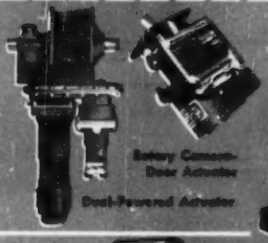

Rotary Cowl-Door Actuator

Dual-Powered Actuator

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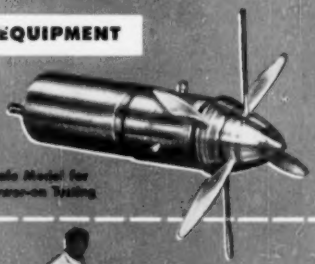
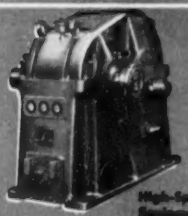
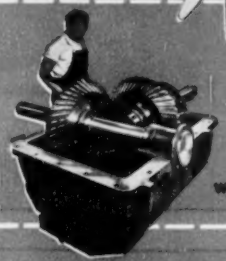


Scale Model for Power-on Testing



High-Speed Test Equipment

WIND TUNNEL EQUIPMENT



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LETTERS

In Airlines' Defense

As a long-time air traveler I feel compelled to answer Dr. Fred A. Ellis' letter to you which appeared Nov. 17.

It is unfortunate that the stewardess (Northwest, obviously) did not give him a more complete explanation of the difference between existing coach and first-class service. At present, the basic difference, aside from density of seating, is the scheduling; most coach flights originate in the late evening or early morning hours which are unpopular and inconvenient. No meals are served and usually one flight attendant is carried.

I can appreciate the step-down feeling which results from a change to 1946 equipment from a 1950 aircraft, but I do not believe it to be any more pronounced than the change from a postwar Pullman car to the 1910 models which seem to represent the majority in use.

As one who has participated as a paying passenger since the day of the Mailwings, and who even survived the difficult (for passenger and operator alike) 1946-49 expansion period, I marvel at the progress airlines have made. And I resent slurs like "alleged mechanical trouble." This was probably a thoughtless remark since even the severest critics have never accused the industry of purposely grounding ships without reason.

Northwest, in particular, has had an oversupply of troubles and I hope this letter will help to balance that of Dr. Ellis.

Ray P. Von Culin, Sales Manager
American Aluminum Ware Co., Inc.
366-378 Jelliff Avenue
Newark 8, N. J.

From Safety Council

I was very much interested and pleased to read that you had named Alexander McSurely as Aviation Safety Editor. We regard this definitely as further indication of your interest in safety, and we think it is a big step forward both for safety and the aviation industry.

Paul Jones
Director of Public Information
National Safety Council
425 North Michigan Ave.
Chicago 11, Ill.

CAB Meddling?

Recent actions by the Civil Aeronautics Board in their attempt to force a merger of Colonial Airlines and National Airlines appear to reach an all-time record example of partisan action by an "impartial" government agency, ostensibly acting in the public interest.

Both National and Colonial have been beset with management and employe relations problems in recent years. The capability of these two firms to merge under National Airlines management and to then operate in the "public interest" seems questionable.

On the other hand, CAB is opposing an offer by Eastern Air Lines to effect this

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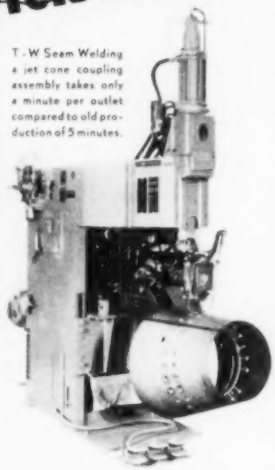

Any one of them uses T-W Resistance Welders to meet Military Specs

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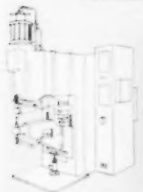


RESISTANCE WELDERS SINCE 1898

TW TAYLOR-WINFIELD
RESISTANCE WELDERS

merger; an offer which has the full accord of Colonial management and stockholders. CAB affects an attitude of indignation, accusing Colonial of placing purchase price ahead, in importance, of aspects of the public interest.

The desire to sell to the highest bidder is merely one of the characteristics of free enterprise upon which the power and might of the United States is based. I wonder if it occurs to CAB that Mr. Dykes could be interested in the welfare of his employes and stockholders in wanting to team up with a company whose reputation is synonymous with excellent management and financial responsibility.

In spite of the obvious stability and soundness of Eastern's organization and its undisputed ability to efficiently absorb and operate Colonial's routes, CAB now schedules "hearings" which will no doubt involve months of delay, to determine if there is any way to force a union of Colonial with National.

It appears that CAB meddlers are trying to combine two minus quantities to form a plus quantity.

Lt. Col. E. T. Lippincott, USAF
A-4 Maintenance Division
Headquarters USAFE, APO 633
c/o Postmaster
New York, N. Y.

Safe Air Show

We heartily concur with your continuing program to discourage, if not to outlaw completely, air shows of an exhibitionistic nature.

As an example of what we consider the beneficial type of air show, the Aeronautics Commission of Indiana, for the third consecutive year, has sponsored an aviation exhibit at the Indiana State Fair. This is an industry-wide exhibit which has been viewed by an increasing number of people; this year it was estimated some 50,000 persons visited the exhibit.

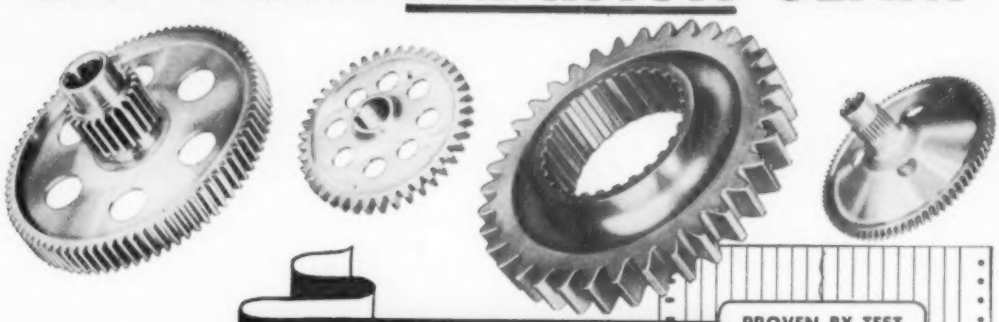
The Commission's sponsorship involved a very minimum of expense—Bendix Aviation Corp. and Allison Division, General Motors, assuming the major portion of the decorative expense.

No CAA waivers were required for low altitude flying, no air show liability insurance premiums had to be provided—and a minimum of personnel, not exceeding three or four people at any one time, were required to staff the exhibit and meet the visitors. No thrills—no spills—but the crowds came—and liked what they saw.

This year the exhibit lasted for a period of ten days and was considered the most successful in every respect, appealing to the eye and the ear. Allison's newest turboprop engine and Bendix's huge carburetors brought out the latest engineering developments in these lines, the Ninety-Nines displayed the advantages of airmarkers, Indiana Aviation Trades Association and the Civil Air Patrol cooperated with us by exhibits and the CAA Technical Development and Evaluation Center provided information on instrument approach lighting and radio equipment development.

Interesting travel illustrations and information by airlines serving Indiana urged visitors to vacation or travel to places they could

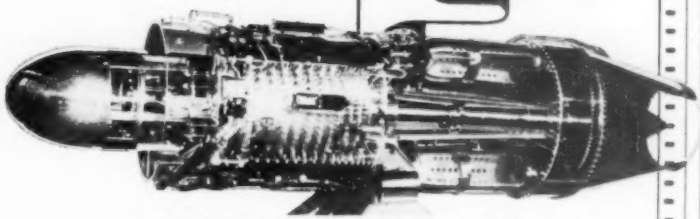
Sier-Bath PRECISION GEARS



PROVEN ACCURACY

FOR THE AIRCRAFT INDUSTRY

PROVEN BY TEST
on the latest gear checking equipment. The chart shown here is from a "Red Liner" instrument, which records character, location and magnitude of six different possible errors.



General Electric J47-GE-13 Engine, cut-away model

Martin XB-51 Tactical Bomber — powered by three General Electric J47-GE-13 Engines

PROVEN BY USE
in today's leading aircraft. For example, Sier-Bath gear components are used in General Electric J47-GE-13 Engines . . . which power the two aircraft shown at left, among many others.

North American B-45 "Tornado" Bomber — powered by four General Electric J47-GE-13 Engines

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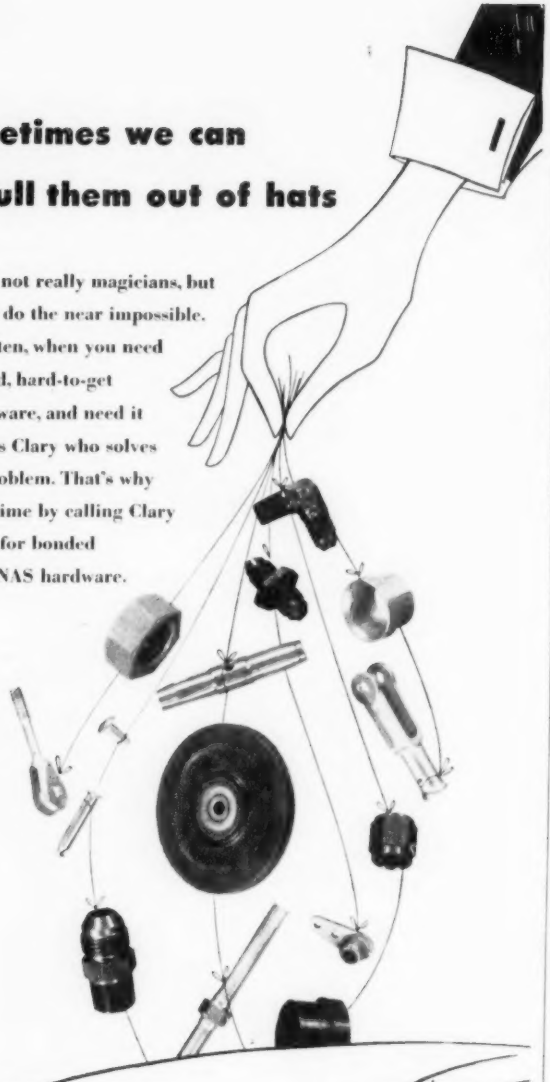

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not otherwise visit due to the time element and this was enhanced through the use of color movies (with sound) reflected from a mirror, set at an angle, into the back of an empty TV cabinet. The image was viewed through frosted glass in the cabinet.

That is the other side of the "exhibition" picture.

The pendulum in aviation has swung from glamor to utility, from daring to safety and from intuition and experimentation to knowledge. The automobile and railroad have faced these same problems and have provided their share of thrills to an uninitiated public and it is about time the airplane settled down to its job of being the modern means of transportation.

C. F. Cornish, Director
Aeronautics Commission of Indiana
Indianapolis 4, Ind.

The B-52 Story

We were all greatly impressed with the treatment you gave the Boeing B-52 in Aviation Week. We thought Alex McSurely did an outstanding job on the subject, especially considering the limited amount of material we could give him on the airplane. The picture layouts were excellent also.

I was pleased that it was Aviation Week which was first to carry this thorough and constructive coverage of the subject. Thank you for the interest you have taken in it.

Harold Mansfield, Director
Public Relations and Advertising
Boeing Airplane Co.
Seattle 14, Wash.

My return to the office after a vacation was brightened by your excellent story on the B-52. I have heard nothing but praise from our people on "that swell story Alex McSurely wrote" . . .

We also were pleasantly surprised at the fine coverage AP gave your story. . . .

Gordon S. Williams,
News Bureau Manager
Boeing Airplane Co.
Seattle 14, Wash.

Praise

I have been reading your magazine for some time and have found it to be an encyclopedia of modern aviation that is a credit to the aviation industry.

I am presently assigned as the chief pilot for the 1739th Ferrying Sqdn. (MATS).

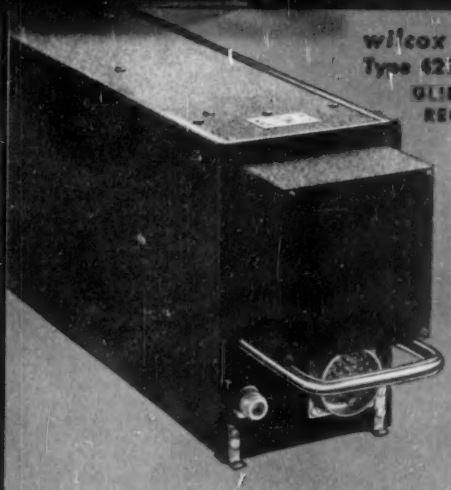
Lt. Bernard R. Knight
1739th Ferrying Sq. (MATS)
Amarillo AFB, Tex.

We of the staff of Commander, Fleet Air Jacksonville, receive Aviation Week regularly. It is routed to each member and is much enjoyed. It is by far the most authoritative and interesting aviation magazine. . . .

R. G. D.
Jacksonville, Fla.

That is a good editorial of yours on "Air Freight and Defense."

Langdon P. Marvin, Jr.
Research Professor of Air Transport Economics
Georgetown University
Washington, D. C.



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For more information, write to Westinghouse Air Brake Company, Industrial Products Division, Wilmerding, Pennsylvania.

AIRCRAFT SECTION

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INDUSTRIAL PRODUCTS DIVISION

MATS Still Hoping for Jet Transport

- **Proposed design competition still may be behind civil airline plans because of tactical priorities.**
- **But general indicates in interview that more AF support for jet liners may be expected in future.**

U. S. airlines are still ahead of U. S. military aviation on jet transport plans, judging by Air Force's current "study" of jet transport feasibility. It looks as if Boeing Airplane Co. will be first to give definite answers on jet transport capability by building and flying one by 1954. After that, airlines, Military Air Transport Service, Strategic Air Command and others may all go for jet transports.

Air Force has delayed and even hindered transport applications of jet power until recently, but some Air Force groups are anxious to get going on it. Foremost among these is the Military Air Transport Service—the scheduled airline of the Defense Department.

▶ **USAF Jet Transport Study**—MATS commander Lt. Gen. Joseph Smith reports that MATS has recommended a jet transport design study competition, to be followed by Air Force award of engineering funds to the winner for prototype construction. But Air Force does not at this time plan to allocate funds to such a project, industry observers report.

Here are the "requirements" Gen. Smith says MATS suggested last year for a jet transport:

- Normal payload 25,000 to 30,000 lb.
- Normal range 2,500 mi.
- Cruise speed 630 mph.
- Takeoff and landing 6,000 ft.
- Cargo compartment: length 40 ft.; width 10 ft.; height 9 ft.
- Deck height above ground 45 in.
- Takeoff over 50-ft. obstacle, land with brakes only.

Airlines and manufacturers criticize several of these requirements as unrealistic. A cruise speed of 630 mph. would cause inordinate fuel consumption regardless of design. The 10-ft. width of the cabin is narrower than the 12-ft. width advocated by the airlines since their conversion to the high-density seating philosophy (five and six-abreast seating) for future transports. And the low, 45-in. height of the deck would penalize the payload because of its requirement of more structural beefing and different aerodynamics, Douglas Aircraft believes.

▶ **Why MATS Wants a Jet**—Gen. Smith told AVIATION WEEK: "My own belief is that the most critical cargo MATS will haul in war will be personnel." That makes the major requirement the same as that of the airlines—speedy movement of passengers whose time is valuable.

Gen. Smith explained it this way: In another war, the U. S. would not only be the arsenal of production, but would also have large armies in the field, across oceans. The only way to maintain both effectively is to minimize waste of personnel's brains and abilities. The jet transport would do that.

"Therefore," he said, "I'm mainly interested in over-ocean transport of people and high-priority cargo." And the jet would be "terrific for air evacuation of casualties," he added, not only because of superior speed and reliability but also the smoothness of the ride.

As for cargo, Gen. Smith emphasized need for speedy movement of small, valuable, scarce loads like electronic gear and fissionable materials. He cited the need for whole blood in Korea, and recalled that big bazookas that were so urgently called for there, just as they started coming off U. S. production lines.

▶ **Cargo De-emphasized**—"Air transport at this stage of the game is still a premium business," Gen. Smith told AVIATION WEEK. Both the commercial freight carriers and MATS are looking for huge payload capacities to cut unit cost, he said, but he did not think there is anything bigger than the C-124 scheduled soon.

He emphasized that MATS is not so much a mover of bulk loads as a rapid transit system for personnel and relatively small high value bits and pieces to many points.

He indicated that the cargo airlines appear to be ahead of MATS in their belief that a 100,000-lb. plane would save money over surface transport on a large proportion of the bulkier, lower-value supplies.

Here again, the airlines may be ahead of the Air Force on demand for transport application of turbine power—turboprop power in the case of heavy cargo planes. Although industry observers report that Douglas has a "Phase 1" contract for design study on a 100,000-lb.-payload transport, a Douglas official denies it.

Convair and Douglas officials are apparently still trying to sell the idea to the Air Force.

▶ **Jet Transport**—Thus it appears that Air Force jet transport evaluation is still only in the few-thousand-dollar paper study phase, and there is some question whether the turboprop 100,000-lb. cargo plane is any farther along—perhaps is even farther off.

Gen. Smith said MATS is looking to about 1960 on the present "system study"—which will go to the Pentagon and the Air Research and Development Command in Baltimore long before MATS sees it. Lockheed began its "study" contract last spring, but Boeing and Convair have just started.

The study was hastened by Senator Pat McCarran's criticism of the Air Force last spring for opposing civil appropriations requests for jet transport prototype construction. Such development work might "divert" manpower and facilities from higher-priority military projects, Air Force said.

Revise ILS Charts

Aeronautical charts for use with instrument landing systems have been improved to meet civil and military requirements.

Two colors are now being used for easier readability of data: base information is black and aeronautical data is in blue.

The profile box, formerly on the landing side of the chart is now on the approach side and is similar to the standard profile indicated on other charts of the AL series.

The landing side of the chart has been revised to include a relatively large-scale drawing of the airport area out to the middle marker and detail information on approach and runway lighting is given pictorially and in writing.

Also, the complete ceiling and visibility minimums for civil plane takeoff, circling, straight-in and alternate are shown in the lower section for planes with stall speeds of 75 mph. or less and for over 75 mph.

It has been unofficially estimated that all the new charts will be finished within a year.

Airlines Fight for Far East Routes

Civil Aeronautics Board will re-allocate airline routes across half the world in its "Trans-Pacific Certificate Renewal Case," just reported out of prehearing conference by Examiner Thomas L. Wrenn.

Major fights in the giant case will be:

• **Pan American vs. Northwest** for the short Great Circle route from Alaska to Tokyo, now operated by Northwest but sought by Pan American. PAA operates the longer mid-Pacific route, plus a stub-end Seattle-Alaska route. PanAm may not come out openly for denial of Northwest renewal but hardly can be expected to champion it.

• **Northwest vs. TWA** for a Tokyo-Bombay route parallel to but not all the way competitive with Pan American's Tokyo-Calcutta route.

• **Pan American vs. both TWA and NWA**—To protect its India-Japan route from the proposed competition of the other two lines.

Pan American probably will hold on to its major routes from India through the Orient and across the mid-Pacific to the U.S.

Although TWA would like to ask a 'round-the-world extension all the way from India through Japan and across the Pacific to the West Coast, fact may prevent such a request in this case. Pan American, having no domestic routes, would suffer a competitive disadvantage if TWA got a 'round-the-world route in addition to its well-established and lucrative transcontinental U. S. market it already has.

Outlook is for Northwest and Pan American to keep substantially those major Far East routes they already operate.

If any line gets a second India-Japan route (in addition to PanAm's), TWA is considered more likely than Northwest at the present time. TWA already had India-China rights but was prevented from implementing that route by the Communists.

Northwest and TWA would offer "connecting" 'round-the-world service competitive with Pan American. Their major advantage over Pan American would lie in both having transcontinental U. S. routes to tap the interior U. S. travel sales market.

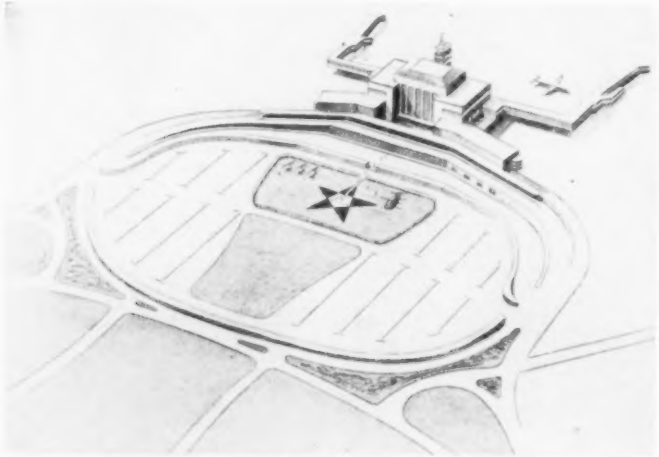
▶ **Other International Routes**—Meanwhile, CAB is expected to deny motions of some airlines to consolidate the U. S.-Alaska and U. S.-Honolulu cases with this trans-Pacific case.

Also, Pan American is expected to be leading contender for a trans-Arctic route directly linking the West Coast and Northern Europe, as Scandinavian Airlines System plans now.

Nonskeds Get Permits

Two additional nonsked charter airlines, limited to using planes having disposable loads up to 6,000 lb., have been licensed to operate into Canada from Alaska by the Canadian Air Transport Board.

The ones granted permission to fly into the Yukon Territory and British Columbia to points west of 120 meridian longitude are Alaska Coastal Airlines, Juneau and Ellis Air Lines, Ketchikan.



HELIPORT FOR FT. WORTH TERMINAL

When Ft. Worth's new International Airport opens early next year, one of its features will be a designated heliport, marked by star on ground in front of administration building. Facilities for fixed-wing aircraft are on the other side of the building.

Rickenbacker Calls Off ATA Withdrawal

Air Transport Assn. directors at their annual meeting in Washington last week welcomed the return of Eastern Air Lines president E. V. Rickenbacker to ATA. Rickenbacker relented on his threat to withdraw Dec. 31 because the directors had refused to promise Robert Ramspeck the ATA presidency last spring.

They avoided official discussion of United Air Lines president W. A. Patterson's attack on the industry for operating high-density air coach, which he claims is unsafe and should be curbed instead of promoted by CAB.

In an informal conference, Patterson explained why he decided coach unsafe. Other airline executives including American Airlines, president C. R. Smith disagreed with him, saying his claims are not substantiated by the record nor by his Cornell evacuation tests in which passengers got out of DC-4s in less than a minute and a-half. Patterson said the tests showed that passengers might take three minutes in a real emergency.

ATA directors approved membership of the recently reorganized cargo carrier U. S. airlines (Slick and the Flying Tiger Line are not members).

They voted a January-June budget unofficially estimated at about $500,000, and debated once again an additional budget proposal for an ATA advertising program which would boost air travel.

Members voted to defer start of a proposed monthly sample survey of traffic origination and destination at cities on trunk routes, pending further study.

ATA also set up a committee to study possibilities of copter operation in regular line haul over their certificated routes.

New German Airline To Buy 24 Planes

(McGraw-Hill World News)

Bonn, Germany—West Germany will buy 12 four-engine and 12 two-engine transports from foreign firms for the nation's first postwar airline, scheduled to begin operation when the Bonn conventions concluded with the Allies go into effect.

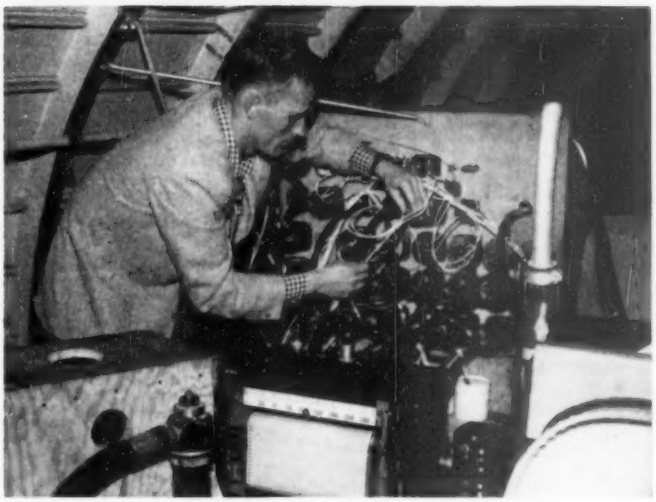
The Transport Ministry also announced it will form a company this month to turn out equipment for the airline. The carrier will be operated with government and private capital.

The airline will operate scheduled flights to the United States, South America, the Middle and Far East, Africa and to other European nations.

House Criticizes SEC On K-F Statement

A House Interstate and Foreign Commerce Subcommittee last week criticized Securities and Exchange Commission for approving Kaiser-Frazer Corp.'s 1947 registration statement, marking another round in the K-F battle with Otis & Co., underwriters.

The K-F statement estimated earnings of $4 million subject to year-end adjustment. The issue is whether the $4-million estimate was misrepresentation. Taking the side of Otis, the House group declared that in approving the statement "the Commission and its staff were either 'asleep at the switch' or deliberately ignored the facts which were made available to them." The group intends to continue the investigation.



C-46 FLIES ON AUXILIARY JET ALONE

Loaded to 48,000 lb., a Flying Tiger Line C-46 freighter (in top photo) is seen 14,000 ft. over Santa Monica Bay, Calif., in level flight with both props feathered. Answer: The C-46 is kept aloft by an 880-lb.-thrust Turbomeca Marbore II French turbojet engine mounted under its belly. In lower photo, Tiger chief engineer Paul Miller checks rear of auxiliary jet's control panel, which is fitted with an automatic graph recorder. The freight carrier and Continental Aviation & Engineering Corp. (Continental Motors subsidiary), licensed to build the baby jet, have been working on the flight test program for about six months. The engine weighs only 299 lb., is 82 in. long and has a 25-in. diameter. Both firms have been working on the C-46 program in an effort to determine the engine's usefulness in extending life of twin-engine transport planes.

having high strength fastener problems?

hi-shear rivets offer many solutions! here are three—

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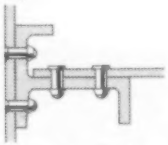
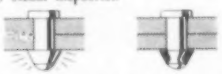


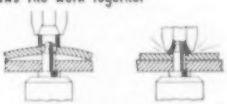
HI-SHEAR rivets simplify design and riveting problems. They are compact, require less tool clearance and have the smallest "headed ends" of any high strength fastener.

fast visual inspection



HI-SHEAR rivets are visually inspected, rapidly and accurately. When the outside of the collar is smooth and neatly trimmed the inspector KNOWS the collar fills the grooved pin end. Only HI-SHEAR trims the collar as it drives — the positive check for tool wear, correct pin length and complete driving.

draws the work together



The HI-SHEAR collar (opposing the pin head and acting as own draw set) automatically draws the work together, instantly and firmly. "Flashing" which occurs with conventional aluminum riveting is eliminated, thus reducing work spoilage.

your copy

of our 60 page booklet "Riveting with HI-SHEARS" containing useful installation and inspection data is awaiting your request.

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PROBLEM: To perform vibration tests to MIL-E-5272 and other specifications.

SOLUTION: The MB Model C-25 Vibration Exciter *rated at 2500 pounds force.*

Shake testing gives a quick method of developing a product to withstand vibration. Such testing is vital in aviation. To meet the need, MB has applied its specialized vibration engineering to develop a range of shakers in various ratings for testing everything from electron tubes to airframes.

The big C-25 model develops large "brute forces" to meet vibration requirements of specification MIL-E-5272. It has heavy duty capacity for a wide range of work, including fatigue testing, shake testing of all types of electronic, electrical and mechanical components.

One of the largest and most dependable electromagnetic shakers available, the C-25 model is a good example of vibration engineering that has made MB "headquarters" for products to *isolate, control, reproduce, detect,* or *measure* vibration. More information on shakers in Bulletin No. 1-VE. Write us.

The widely used Pedestal MB Mounts, too, are produced by...

THE MB MANUFACTURING COMPANY, Inc.
1067 State Street, New Haven 11, Conn.

Capital to Protest Route Restrictions

Capital Airlines is preparing a campaign to persuade Civil Aeronautics Board that its major routes should be freed from restrictions placed years ago to prevent competition at taxpayer expense.

Now that the major carriers are off subsidy, the airline claims, the arbitrary limitations merely rob its profits to pay the Big Four—American, Eastern, TWA and United. Capital will contend to congressmen and CAB that the restrictions actually may force it back under subsidy.

▶ **The Reasons**—These arguments will be presented:

The airline has long-standing applications to CAB for removal of restrictions on its New York-Chicago and New York-Gulf Coast major route systems. Approval of the applications would allow Capital to fly direct to major cities along the two routes, rather than detour to small towns that provide little payloads on CAB-required local service patterns.

Company representatives point out that New York, Atlanta, Birmingham, Mobile and New Orleans lie along a logical flight route. But CAB limitations prevent the carrier from serving all these cities on one flight. Capital says CAB forces it to fly half-empty planes instead of one fully loaded transport, keeping it on a non-profit basis and hindering its ability to serve large cities adequately. Atlanta and Birmingham city officials, the airline says, will uphold this argument in briefs before CAB.

▶ **Case Histories**—Capital will cite two other instances in which it claims CAB restrictions proved unjust and uneconomic:

• **Coach curtailment.** Reinstitution of an obsolete government regulation, Capital contends, has removed it from a profitable coach business. First scheduled domestic carrier to develop aircoach, the line contends it was pushed out of its own market when larger competitors entered it.

Capital started the first coach service—the midnight New York-Chicago "Night Hawk" in 1948. For experiment, CAB reduced its two-stop requirement to one. Loads were heavy. American and TWA followed with nonstop service and CAB re-imposed the two-stop requirement on Capital. United entered the market, also nonstop, and Capital was forced to withdraw its "Night Hawk" flight because its "detour" operation was untenable in the face of nonstop competition from the other lines.

• **Atlanta-Birmingham loss.** Capital started a nonstop New York-Atlanta service last year in competition with Eastern, but withdrew it this year because CAB limitations prevented service of Birmingham and Gulf Coast cities on the same flight. Eastern, not so restricted, could afford a lower Atlanta load factor.

Capital says this also points up another of its arguments: A non-subsidized carrier does not need CAB to tell it when competition is uneconomic; the law of supply and demand will do it more quickly and surely.

SEC Lists Aviation Stock Transactions

Sale of 14,200 shares of common stock of All-American Airways, Inc., by Robert M. Love, president, leaving a total holding of 52,145 shares, is reported in a recent Securities and Exchange Commission report.

Also reported are the following sales of common stock by officers and directors of Grumman Aircraft Engineering Corp.: L. R. Grumman, director, sale of 5,000 shares, leaving a total holding of 161,000 shares; William T. Schwendler, director, sale of 5,900 shares, leaving a total holding of 50,100 shares; L. A. Swirbul, director, sale of 10,000 shares, leaving a total holding of 10,675 shares.

Other transactions reported by aviation officials are:

• **Beech Aircraft Corp.:** Dwight S. Wallace, director, purchase of 2,000 common shares, making a total holding of 3,950 shares.

• **Capital Airlines, Inc.:** J. H. Carmichael, president, sale of 100 common shares, leaving a total holding of 3,137 shares; Otto A. Deyferth, director, sale of 200 common shares, leaving a total holding of 200 shares.

• **Colonial Airlines, Inc.:** Branch T. Dykes, officer, sale of 500 common shares, total holding.

• **Consolidated Vultee Aircraft Corp.:** LaMotte T. Cohu, officer, sale of 1,000 common shares, leaving a total holding of 4,466 shares.

• **Continental Air Lines:** Joseph A. Ubl, officer, purchase of 100 common shares, making a total holding of 1,317 shares.

• **Douglas Aircraft Co.:** Edward H. McLaughlin, director, purchase of 200 common shares, total holding.

• **Eastern Air Lines, Inc.:** Stuyvesant Peabody, Jr., director, purchase of 20 common shares, in trusts, making a total holding of 80 shares.

• **Fairchild Engine & Airplane Corp.:** Floyd S. Bennett, Jr., officer, sale of 200 common shares, total holding; Earnshaw Cook, director, purchase of 100 common shares, total holding.

• **Flying Tiger Line, Inc.:** James E. Davidson, director, sale of 2,600 common shares, leaving a total holding of 7,800 shares.

• **Lockheed Aircraft Corp.:** H. R. Campbell, officer, purchase of 660 capital shares, making a total holding of 2,000 shares.

• **Pan American World Airways, Inc.,** Franklin Gledhill, officer, purchase of 521 capital shares, making a total holding of 2,233 shares.

• **Sperry Corp.:** Reginald E. Gillmor, officer, purchase of 400 common shares, total holding; Charles Ondrick, officer, purchase of 100 common shares, total holding.

• **Trans World Airlines, Inc.:** Powel Crosley, Jr., director, purchase of 80 common shares, making a total holding of 1,200 shares.

Jet Liner Ground Problems Discussed

Necessity for mounting jet engines in aircraft sufficiently distant from ground level so airport pavements will not be adversely affected by exhaust blast and heat was stressed during a recent International Civil Aviation Organization symposium at Montreal, Canada.

British experience with the DH Comet jet transport reportedly has shown no trouble of this nature, but the U. S. delegate to the conference reported that difficult and serious pavement problems can be experienced, particularly when engines are slung close to the ground, as in pods.

U. S. tests had shown temperatures as high as 400-500 F at the ground surface. And it is believed that use of assist devices, such as rockets, afterburners and other augmentation methods will bring on core temperatures of 3,500-5,200 F and exhaust gas speeds of 6,000-8,000 ft./sec. Temperatures 2½ ft. below the core and 25 ft. away are approximately 700 F.

► **Grass Fire Problem**—The British feel that an engine height from the ground equivalent to 3½ times the diameter of engine orifice, and mounting the engine so that exhaust gas axis is parallel to the ground will insure safe operational conditions.

Another recommendation was to remove grass from an area 100-300 ft. from the end of runways to prevent serious grass fires. Ground erosion near pavements is another problem; in the U. S. an asphalt cover running 300 ft. behind runways has been used.

Jet fuel spillage also must be considered, since the fuel evaporates more slowly than conventional fuels and therefore has more time to damage pavement.

Other portions of the symposium brought out:

• **Necessity for insuring** that runways have a reasonable friction coefficient to give high braking efficiency to offset the aircraft's lack of braking from the customary propellers.

• **Taxiing of jet aircraft** is expensive: The Comet uses up to 12 gal./min. or approximately 70% the rate used in full cruising. Taxi-way curves should be such that the planes need not slow down on turns.

• **Because of the necessity** of bypassing piston-engine aircraft while taxiing to maintain economy, piston planes should have holding areas near the beginning of the runway.

• **Care must be taken** in turning a jet plane while engines are active to insure safety of ground personnel and equipment. For the Comet, a 140-ft. margin must be allowed from the jet orifice for this reason.

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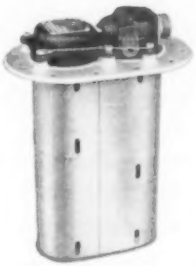

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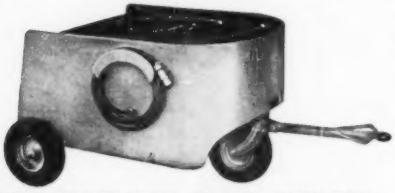

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Patterson Sees Need For Short-Range Jet

Designing the jet airliner to be economical at distances under 1,500 mi. is one problem that has to be licked, as far as United Air Lines is concerned, President W. A. Patterson told members of the Investment Bankers Assn. meeting recently in Hollywood, Fla. "Only 13% of our traffic goes over 1,500 mi.," Patterson said. ". . . and the jet liner will cost about $4 million and any airline or manufacturer which makes a mistake in its selection of the type of plane is apt to go bankrupt."

The British, he said, are buying prestige with the Comet. U. S. airlines are studying designs that will travel at 530-550 mph., climb 1,000 fpm. and cruise at 40,000 ft., Patterson told the bankers, but it will be 1958 or 1960 before jet transports are seen in quantity.

Patterson mentioned UAL's move to reduce the number of seats in its coach services (AVIATION WEEK Dec. 8, p. 13) as "a decision . . . in the interests of safety. We will stay in the coach business, but we are not going to squeeze every last nickel out of the plane."

He also said that the carrier is studying new ground facilities, including airplane docks, to improve efficiency and reduce costs.

CAB Moves to Curb Agency Deceptions

In its first move to use its recently granted power over air ticket agencies, Civil Aeronautics Board has started enforcement action against Skycoach Airlines Agency for "misrepresenting" itself to the public as an airline instead of an agency.

The Board also issued a list of 13 agency practices that it believes punishable under the Civil Aeronautics Act as amended to cover agencies by the last session of Congress.

Chief violations are interpreted by the Board as price switches from official tariffs filed at CAB; failing to make refunds promptly; and ticketing a passenger when the agent does not yet have a contract with the airline to provide the promised service.

► **New System**—Amos Heacock, president of Air Coach Transport Assn., promptly wrote CAB Chairman Oswald Ryan that ACTA was eager to cooperate in stopping unfair agency practices.

Heacock told Ryan that ACTA had been working with International Business Machines Corp. to set up a universal ticket card form and ticket control system to be controlled by the prime agencies—who book space on request of the sub-agents. Heacock asked that CAB study the proposed system

and decide whether it would satisfy the letter of the fair practices amendment.

If not, he urged that an exemption for the system be issued, recognizing that the Act's intent is satisfied and that the technical violation is a necessary part of the nonsked industry's peculiarities.

Promising cooperation to clean up unethical agency practices, Heacock wrote that "it is planned that the Air Coach Transport Assn., as a ticket agent (although engaged almost exclusively in ticketing men in uniform), shall make complaints to the (CAB) Office of Enforcement against any or all other ticket agents engaged in 'unfair or deceptive practices and unfair methods of competition or who are guilty of offering rebates or of overcharging the general public.'"

Atlantic Airfreight Case Delay Forecast

The trans-Atlantic airfreight case –which started in 1947 with applications of Seaboard & Western and Transocean Airlines for cargo-only certificates–has only a 50-50 chance of decision in 1953. Civil Aeronautics Board has denied Seaboard's request for consideration of the case on the present record.

So the case is now definitely slated for complete rehearing. It is broadened to include six applicants plus the two principal intervenors opposing CAB issue of the new certificates–Pan American and TWA.

The Board plans trial examiner hearing by Mar. 1, 1953. But the Board may not make that preliminary deadline. First exhibits are due about New Year's Day, with rebuttal exhibits due 15 days later.

Applicants in the case are: Seaboard and Transocean–original applicants; European-American–third applicant, whose case was consolidated from another; and Flying Tiger Line, Trans Caribbean and Overseas National–new applicants since the case was opened for rehearing.

Flying Tiger Moves

Flying Tiger Line has moved its New York area operations headquarters back to Newark Airport from its temporary location at Idlewild. The carrier set up headquarters at Idlewild following the shutdown of Newark last winter.

All New York area flights will be centered at Newark, but the carrier still is operating its Idlewild shipping docks and those at 474 Tenth Ave. in New York. Flying Tiger will open a big maintenance and operations base at Westchester County Airport, N. Y., next year.

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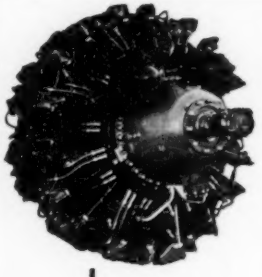

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71	9987Y13Z1	Weston	Oil Temp Indicator
40	119862	Weston	Carb. Air Temp Indicator
18	15401-1	Eclipse	Amplifier (PB10)w/ED3 MOUNT
66	10078-1AG	Eclipse	Gyro Indicator
68	CO-9	Eclipse	Clutch Switch (PB10)
57	MF45-3911-20Z	Vickers	Hydraulic Pump (3000PSI)
387	PF4-713-10BCE	Vickers	Hydraulic Pump
75	1416-19E	Eclipse	Starter
142	18008	Airesearch	Jack (Cowl FLAP)
45	AN4103-2	Clifford	Brass (Valve #U4785) Oil Cooler
120	MF9-713-15A	Vickers	Hydraulic Pump
530	TFD 8600	Thompson	Fuel Booster Pump
125	D7818	Adel	Anti-Icer Pump
250	AN4014	Erie Meter	Wobble (D-3) Pump
1008	AN5780-2	G.E.	Wheel & Flap Position Indicator
400	AN5780-2	Weston	Wheel & Flap Position Indicator
115	P4CA2A	Parker	Primer
70	AN3213-1	Scintilla	Ignition Switch
450	A-9 (94-32226)	Nasco	Ignition Switch
90	JH950-R	Jack & Heins	Starter Motor
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11	19086-1C	Eclipse	Amplifier
250	558-1A	Eclipse	Oil Separator
100	716-3A	Eclipse	Generator (NEA-3A)
89	318	Edwards	Horn
230	921-B	Stewart-Warner	Heater (200000 BTU)
97	6041H-146A	Cutler Hammer	Relay (B-12)
22	0655-D	Aro	Oxygen Regulator
65	ASDC2	CO_2 Mfg. Co.	Fire Detector
384	564-2A	Eclipse	Oil Separator

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814	35814	Blower Ass'y
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56	48392	Sump
390	48461	Gear
78	76836	Gear
1178	84289	Bearing
113	84487	Housing
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185,000	LS4AD1	Spark Plug (Aero)

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SHORTLINES

▶ **Air Transit Services,** a new Washington, D. C., company which advances to airlines immediate full cash on completion of official military contract flights, at 1% fee, already has served about 20 lines. These include smaller scheduled airlines of ATA as well as members of ACTA and IMATA. Company discounts the military receipt (transportation request) with American Security & Trust Co.

▶ **American Airlines** and Continental have linked teletype systems to facilitate reservations clearance on through-service interchange Houston-West Coast.

▶ **Australian National Airways** intends to purchase Blackburn Universal freighters in England to handle cargo loads of up to 26 tons. Bristol Freighters are now used by ANA who will receive a government-guaranteed loan to reequip its fleet.

▶ **Butler Air Transport,** New South Wales, Australia, airline, has taken delivery of its first DH Heron and, if satisfied, may decide to re-equip entirely with Heron aircraft. In the meantime it will use its DC-3s.

▶ **California Eastern** president Sam Solomon plans to visit Japan about the first of the year to try to determine plans for certification of a trans-Pacific airline. Cal Central has an operating contract with Japan International World Airways, while Transocean has one with Japan Air Lines, which holds the inside track because of its domestic certificate.

▶ **Civil Aeronautics Administration** Prototype Testing Committee is asking $1,538,000 for fiscal 1954 operations—mostly simulated jet transport operation to forecast airways, airport requirements and aircraft certification standards. . . . CAA jet-turboprop evaluation team is made up of six West Coast and five Washington CAA officials, since virtually all major transport manufacturers are based on the West Coast. . . . CAA says 62 low-frequency (L/MF) radio ranges will be subject to decommissioning orders after next June, because they will not be needed by military planes. One by one, CAA will turn them off as regional chiefs decide the newer VHF facilities are adequate.

▶ **Civil Aeronautics Board** will be without a (three-man) quorum to make any decisions Dec. 20 to about Jan. 2, and even this week is unlikely to decide any controversial cases, as Chan Gurney is on vacation, leaving only Josh Lee, Joseph Adams and Chairman Oswald Ryan. Adams will be the only member in Washington between Christmas and New Year's Day.

▶ **KLM Royal Dutch Airlines** order for 13 Super Connies includes four 94-seat "immigrant" coaches. Super Connie (Dreyfus-designed interiors suggested by Lockheed include 47-seat luxury, 59-63 seat standard, and coaches of 94 seats with overseas relief crew or 99 for domestic service).

▶ **National Airlines** starts its first daily nonstop service New York-Havana Jan. 1 with DC-6s.

▶ **Pioneer Air Lines** has a CAB show-cause order renewing its certification to serve New Mexico, on parts of which traffic is now averaging up to 15 passengers per flight.

▶ **Resort Airlines** has doubled U. S. tour service to Guatemala and plans expansion into Columbia, Venezuela and PAA soon.

▶ **Scandinavian Airlines System** successfully completed its second trans-Arctic delivery flight of DC-6Bs from Los Angeles to Europe—this time to Oslo.

▶ **Slick Airways** has moved its Washington terminal to larger quarters at Baltimore's Airport. Company operates 22 C-46s and 2 DC-6As, one of which will be sold upon delivery of a newer DC-6A replacement.

▶ **Southern Airways** has a CAB show-cause order setting temporary mail pay at $1,800,671 for the year ended Sept. 30 (equal to 54 cents a scheduled plane mile), and 62 cents a mile as the present temporary rate.

▶ **Tasman Empire Airways Ltd.** is still thinking of extending its Tahiti flights to Honolulu but this will depend on which other airlines are going to operate on this route. Latest mentioned as interested in this route is Pan American.

▶ **Trans-Australia Airlines,** domestic government-owned airline, will fly on Australia-New Zealand routes. TAA's Skymasters will operate charter flights from Melbourne, Australia, to Christchurch, N. Z., for Tasman Empire Airways Ltd., who find it impossible to take care of the heavy summer rush on this route.

▶ **Trans World Airlines** 'round-the-world route survey team was slated to arrive back in the U. S. Dec. 14. Bombay-Tokyo route application may be the forerunner of a TWA request for a final Tokyo-San Francisco link, some CAB staffers believe.

STRICTLY PERSONAL

People

Bill Klenke, ex-sales manager of Stinson, is with W. L. Maxson Corp.'s Switch division . . . **Bill Lear** backs **Babe Meigs** as a candidate for Secretary of the Air Force. Bill, incidentally, is enthusiastic over CAA's certification of his new autopilot for airliners . . . **Deac Lyman** has rubbed out that moustache . . . One aircraft company top executive suggests Thompson Products prexy, **Fred Crawford**, as Air Force Secretary. He's got industry experience—no doubt of that . . . Several important airline presidents are banding together to boost CAA Administrator **Charlie Horne.** They're afraid a new Administrator might be worse! . . . We hear that **Jimmy Doolittle's** name is still prominently mentioned to replace **Finletter** . . . Kaiser-Frazer says it's trying to get Air Force approval to release its cost figures at Willow Run, but so far no success . . . **K. T. Keller,** boss of the Defense Department's Office of Guided Missiles, took **Larry Bell** on his most recent inspection tour of the various missile companies. Bell was the only member of the party outside of Keller's own staff . . . **Arthur Godfrey** was the chief speaker at American Legion Post 501's annual banquet in New York the other night. It was the first such gathering to which the ladies were invited; jokes were tamer . . . That eminent Strictly Personal author, Doktor **Von Flugen,** has deserted CAA, along with many other capable engineers, and has returned to Blizzardy California to join a major aircraft company. His two youngest children are recovering from light attacks of polio. We still get inquiries from readers, asking when the Doktor will resume his scholarly writings for this column. Soon, we hope . . .

* * *

Seniority, Sex & Salary

TWA's Capt. **Dave Kuhn** wrote this for the ALPA Air Line Pilot, titled, "Seniority, Sex & Salary"—

"With sex, it's the end result that counts. Most pilots fancy themselves as great lovers. The facts reveal many discrepancies in that line of thought. Any hostess will tell you that the most useless thing on a date is a pilot with a 20-year pin.

"Pilots approach sex in much the same manner they execute an ILS approach—fast and by the book. Being victims of habit, they are trying to conform to schedule . . ."

* * *

Grandstand Observer . . . Ex-president of TWA, **Jack Frye,** has established a trophy to be given as an annual award to the U. S. certificated airline flying the fastest scheduled flight. Jack, who has been head of General Aniline & Dye, may be looking toward aviation again, some folks think . . . Reshuffling of key jobs in Navy's BuAer finds Rear Adm. **Lloyd Harrison,** widely known in the aircraft industry for his work in materiel, taking over as deputy to Rear Adm. **T. S. Combs,** Bureau chief. Harrison succeeds Rear Adm. **Theodore C. Lonnequest,** who becomes the BuAer general representative for the midwest states with HQ at Dayton.

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EDITORIAL

The Complexity Problem V

By Brig. Gen. Leighton I. Davis

Gen. Davis prepared this address for delivery before the Cleveland-Akron Section of the Institute of the Aeronautical Sciences, with the title, "The Weapons Systems Concept." It is the most recent official comment from the U. S. Air Force's Air Research & Development Command on the vital subject of aircraft complexity. Gen. Davis is Director of Armament in the Office of the Deputy for Development of ARDC.

(Second of Two Installments)

The third term, the probability of hitting, may be the margin of over-all performance that accounts for the success of the F-86 over the MiG. If so, these day-fighter engagements are proof of the soundness of our weapons system concept—they are the measure of the payoff for balanced design.

One significant difference between the enemy "weapons system" represented by the MiG-15 and its cannon, and the F-86 and its machine guns, is the U. S. use of a fire control system for aiming the guns. The F-86 has a small automatic radar that automatically measures range to the target and continuously furnishes this information to the computing system. Gyroscopes measure the rate of turning of the aircraft (which is a measure of the relative speed of the aircraft and the angles involved), and the system automatically computes the lead angle. In addition, it provides an indication of the size and direction of lead.

After the pilot has found an enemy, he must close to the effective range of his guns, "track" the enemy on the target, then fire the guns.

Hitting a moving target is very difficult, as anyone who has shot at a jack rabbit from a moving car will know. Jet airplanes are very small and the time available to aim is only a matter of seconds. They enter combat at ten miles per minute and break away in circles which may carry them out of sight of each other. The enemy twists and turns and dives and zooms in maneuvers which test the stamina of the pilots to withstand the accelerations. In this combat, no human being has the sensory capability to measure the enemy speed, the range, and the angles involved. If he did have the exact data required, the time available is too short to make even the simplest calculation. Even though the pilot may seem to be directly behind his target, the motion of the two airplanes turning in space will cause the bullets to miss the target. Therefore, to strengthen this part of the "weapons system" team, the Air Force has adopted electronic and gyroscopic equipment to help the pilot. This equipment weighs 85 pounds for the radar and 120 pounds for the computer and optics. That weight is about 2% of the total aircraft weight and represents about 4% of the total cost. We have enough data from pilots' reports and combat film to prove that it is an important factor in the over-all effectiveness of the F-86.

Now, what are we in the Air Force doing about "complexity?"

You know, and I know, that we cannot win any future all-out war solely with numbers of people and with quantities of equipment. We cannot match the manpower of a potential enemy. We must have better equipment manned by fewer bodies.

Incidentally, when we speak of complexity, some people have the idea that our research and development program delays the production schedule. This is not necessarily correct. Once the aircraft or equipment manufacturers have undertaken large-scale production for the purpose of equipping our using forces, the production schedules must and will be protected from delay or disruption due to unnecessary or inadequately considered design changes.

The initial rate of production of new aircraft or equipment will be held to that minimum rate required to produce adequate quantities of the article for engineering, functional, and suitability testing. Once the testing program has demonstrated the final aircraft or equipment configuration suitable for issue to the using agencies, the rate of production will be increased to the level needed to meet inventory requirements.

Now, how do we accomplish this action?

There are two major commands in the U. S. Air Force directly concerned with quality and quantity. These two commands—the Air Research and Development Command and the Air Materiel Command—work as a team. To secure adequate quantities of aircraft and equipment of the highest quality, it is necessary for those primarily concerned with quality and those primarily concerned with quantity to constitute working teams during the entire life of aircraft or equipment.

Throughout the period when the article is being designed and the initial quantity of test items is being produced and tested, the designated representative of the Air Research and Development Command will act as "team captain." Specifically, the Air Research and Development Command will insure that those configuration changes essential to render the article mechanically satisfactory, capable of accomplishing its mission, and safe to operate, are incorporated into the design.

In a similar manner, during this period the Air Materiel Command will insure that those changes required for efficient production and ease of maintenance are incorporated into the design.

After a decision has been made to produce the article in quantity for inventory purposes and the development tests are well under way, the "team captaincy" normally will be transferred to the designated representative of the Air Materiel Command.

That is the way we are operating in the Air Force.

In conclusion, I would like to sum up my arguments as follows:

The trend in modern military aircraft is toward larger, more complex systems.

The size is determined by range requirements and propulsive efficiency. The Breguet formula expresses this dependence.

"Complexity" is a by-product of the impact of the atomic bomb. The increase in the power of the offensive shifts the emphasis from quantity to quality. Our strategic systems must be able to deliver the goods. Our defensive systems must be able to cope with enemy attacks delivered under any weather conditions, and with the speed of automatic operation.

The net result is a "weapons system." If balance is preserved, it will be an **optimum** system.

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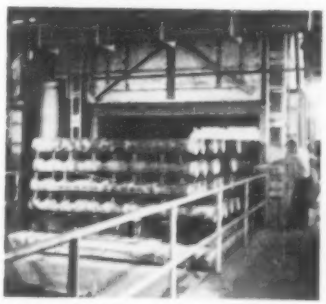
Making the most of aluminum for industry is no mere slogan at Harvey, it's a day-to-day challenge. If problems involving the application of aluminum extrusions to your supersonic and other type aircraft seem insoluble, take them to Harvey where we offer you the experienced and understanding counsel of our expert staff of metallurgists and research specialists. A Harvey Field Engineer is as near as your telephone. Call him today.

HARVEY Aluminum

MAKING THE MOST OF ALUMINUM...FOR INDUSTRY

DIVISION OF HARVEY MACHINE CO., INC.
TORRANCE, CALIFORNIA
BRANCH OFFICES IN PRINCIPAL CITIES



*All aluminum ingots at Harvey are homogenized, that is, strengthened by heating and slow cooling to provide uniform structure throughout.

Cutting Costs instead of Chips

GENERAL MOTORS engineers have come up with a new and extremely simple way of making turbine engine compressor blades that promises to save our country millions of dollars in man-hours, plant facilities, tools and critical materials.

This new method, developed by Delco-Remy Division in cooperation with Allison, is a cold-forming process that brings the projected cost down to a fraction of the present average cost of blades.

The full importance of this development in terms of our national economy is pointed up by the fact that a single jet engine may use as many as 6,000 blades.

Under blade-making methods now widely in use, excess stock is cut and machined away after high-alloy steel, rich in critical material, is forged or cast into the blade form. Delco-Remy, which has a world-wide reputation as an efficient mass producer of intricate automotive equipment, had learned how to cold-form metal by actually *pushing* it into shape, rather than cutting it.

In this way, nearly all of the material goes into the finished product and there is very little scrap from the manufacturing process. Delco-Remy engineers, in collaboration with Allison, adapted this method to blade processing. Blades made in this manner are rolled from cold flat strip stock with no chips to cut—thus saving valuable time in manufacture, as well as large quantities of precious material.

Blades produced by this process have been tested by Allison in T40 engines and their endurance characteristics have proved comparable to standard forged blades and to cast blades.

Developments like this help to explain why Allison turbine engines are produced at lower cost per pound of weight and per pound of thrust than any other turbine engines in the world.

And they offer further proof that Allison does make good use of its opportunity to draw on the special skills and experience of the entire General Motors organization — including the famed GM Technical Center in Detroit. This backing, plus its own vast engineering resources, provides Allison with unequaled facilities for truly advanced accomplishment in better—and less costly—gas turbine engines.

GM
GENERAL MOTORS

Allison

DIVISION OF GENERAL MOTORS
INDIANAPOLIS, INDIANA

World's most experienced designer and builder of aircraft turbine engines

T35 and T71 Axial, T33 Centrifugal Turbo-Jet Engines, T38 and T40 Turbo-Prop Engines